REPORT SOIL VAPOR SURVEY 7100 SECOND AVENUE SW SEATTLE, WASHINGTON

PREPARED FOR

ALASKA MARINE LINES PROJECT NO. 21048-001 September 25, 1990



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#### 1.0 INTRODUCTION

This report documents the activities and findings of a soil vapor survey conducted by Dames & Moore for Alaska Marine Lines (AML) at their facility located at 7100 Second Avenue SW, Seattle, Washington (Figure 1). The soil vapor survey was performed to aid AML in management planning for their underground tanks and to provide preliminary data concerning the potential for soil or ground-water contamination at the site. The field work for the soil vapor survey was conducted by Dames & Moore personnel on August 6 and 7, 1990.

#### 1.1 BACKGROUND DATA

The AML site is a freight management facility where cargo and refrigerated containers are transferred between barges and trucks. The site is heavily used by vehicular traffic during working hours as containerloads are delivered and loaded.

Two underground storage tanks (USTs) are located at the AML site, one 10,000-gallon diesel UST and one 10,000-gallon gasoline UST. The ages of the tanks are uncertain. A line leak associated with the diesel tank was recently repaired, and both of these tanks failed integrity tests that were conducted in April 1990[1]. In addition, a 10,000-gallon gasoline UST formerly present at the site was removed approximately five years ago. The approximate locations of the existing and former USTs are illustrated on Figure 2.

It is the intent of AML to bring the tanks and their site into compliance with existing regulatory requirements for USTs. They plan to remove their existing USTs, replace them with aboveground fueling capabilities, and excavate or remediate any contaminated soil or ground-water associated with the USTs, if present. Because the site is heavily used, it is important for AML to plan excavation work so that disruption of site operations is minimized.

#### 1.2 PROJECT OBJECTIVES AND APPROACH

The objective for this study was to provide a preliminary assessment of the potential for onsite contamination associated with leakage from the existing or former USTs. The approach to the project was to conduct a soil vapor survey and to evaluate the presence of anomalous soil gases in the area of the existing or former USTs.

#### 2.0 FIELD INVESTIGATION

#### 2.1 EQUIPMENT

The soil vapor probes used in this assessment consisted of three-foot-long, 0.75-inch-diameter steel pipes slotted at one end. Each end of the pipe was threaded so that stainless steel conical tips, additional pipe, or vacuum pump tubing could be attached.

An electric Roto-Hammer was used to drill pilot holes through the concrete and to drive the soil vapor probes into the soil. After the probe was driven to the selected depth, a vacuum pump was attached to the top of the probe with a teflon hose and was used to extract soil vapors from the probe. The vapor concentration in the pump discharge was measured every minute for three or four minutes to evaluate soil gas variability associated with time. The readings were collected with a MicroTIP photo ionization detector calibrated with isobutylene. After the tests were completed, the probes were removed from the ground, and the pilot holes were backfilled with asphaltic patching material.

All probes were cleaned and decontaminated with an Alconox-water solution, and rinsed with distilled water prior to their use for sampling.

#### 2.2 BACKGROUND SOIL VAPOR CONCENTRATION

Background soil vapor data were obtained from sample station 001, located southwesterly of the USTs (Figure 2). Soil vapors were collected at depths of two, four, and six feet to evaluate variations in soil vapor concentration with depth (Table 1). Readings were not collected at greater depths because ground water was encountered at six feet. The results indicate that the highest soil vapor readings were obtained at a depth of four feet, but the readings at all depths were generally very similar. In addition, the readings collected each minute of the test were similar. It was decided to collect soil vapor samples from a depth of two feet because less time was required to remove probes from the two-foot depth than from the four-foot depth, and the results from two-foot depths were similar to the readings obtained from the four-foot depth. The results from sample station 001 indicate that background readings are less than 10 ppm.

#### 2.3 EXISTING USTS AREA

Figure 2 illustrates the location of each sample station and the vapor reading obtained from that station. Concentration contours representing the approximate extent of soil vapors that are of equal concentration were calculated from the sampling data and are also shown on Figure 2.

The survey began with sample stations located as near as possible to each side of the existing USTs and continued outward at approximately 20-foot spacings until background soil vapor values (approximately 10 ppm) were obtained. The highest reading (368 ppm) was obtained from sample station 020, located near the southeast corner of the shop. This anomalously high reading may indicate some localized spillage in that area. Readings between 273 and 10 ppm (background) were present in a relatively large area west of the fuel pumps near the USTs and associated piping. An anomalously high value (100 ppm) was obtained at sample station 022 which is located southeast of the USTs outside of the main 100 ppm concentration contour. The cause of this high reading is not known, but this result may indicate that spillage has occurred or that another unidentified source of organic vapors is located in this area.

The results of the survey performed near the existing USTs indicate that elevated concentrations of soil vapors are present in an area approximately 150 feet by 100 feet. The data

appear to be reliable because the readings show a steady decrease in soil vapor concentrations away from a known potential source of contamination (the USTs), as would be expected.

#### 2.4 FORMER UST LOCATION

Ten soil vapor stations were sampled near the location of the former UST (Figure 2). The highest value in this area was 100 ppm which was obtained from station 002. The remainder of elevated soil vapor readings form a northerly-trending linear feature. The cause for this linear feature was not readily apparent until AML employees remembered that a line of approximately five gas pumps was formerly located in this area. The soil vapor data therefore appear reliable because the soil vapor concentrations decrease away from this known potential source of soil vapors, as would be expected. Time constraints did not allow complete definition of the northern extent of the linear feature.

#### 3.0 DISCUSSION

#### 3.1 LIMITATIONS OF SOIL VAPOR SURVEYS

Soil vapor surveys are based on the assumption that soil vapor gas measurements are linearly correlated to the level of volatile constituents present in the soil or ground water. Although the data do not represent the absolute levels of volatile constituents present in the subsurface, they can be calibrated with the results from analytical tests of soil samples collected near soil vapor sample stations. Based on the assumption that the measured soil vapor concentrations are linearly correlated to the concentrations of volatile constituents in the soil, the remainder of the soil vapor readings can thus be converted to the volatile concentrations actually present in the soil.

Soil vapor surveys have been shown many times to be an effective means by which subsurface contamination can be screened. The results of a soil vapor survey, however, are interpretive and should not be used without recognizing that problems are sometimes associated with soil vapor data. Some of the most significant problems are explained below.

- a. Volatile components measured by the field instrument may originate in the soil at a significant distance from the sample station. If significant migration of soil vapors has occurred, the results of a soil vapor survey would result in an overestimation of the amount of actual soil contamination that may be present.
- b. The volatile components that are measured may originate from either the soil or the ground water; hence, it is not possible to identify the true source of the organic vapors without additional study.
- c. Factors such as naturally occurring variations in the soil-air composition and humidity at a site are known to affect the response of detection instruments to organic vapors. Vari-

ations in such factors may result in a non-linear correlation between measured and actual soil vapor concentrations.

d. The correlation between soil vapor readings and the actual concentration of organic components in the soil can only be determined with analytical testing of site soil. In other words, it is not known if site soil containing 100 ppm of total petroleum hydrocarbons (TPH) will result in a soil vapor reading of 1 ppm or 50 ppm.

Therefore, although we believe the data obtained from this survey is reliable, we cannot guarantee that the survey accurately reflects the extent of potential contamination at the site. Sampling and analysis of soil and ground water will be required to quantify the extent of contamination. If a linear correlation exists between the soil vapor data and the levels of contaminants that are actually present in the soil, then the results of the soil vapor survey will significantly reduce the amount of analytical data that will be required to evaluate the possible extent of contamination.

#### 3.2 REMEDIAL PLANNING

The results of the soil vapor survey indicate that a large area near the existing and former USTs may be impacted by leakage from the USTs. It is not known at this time if these readings represent petroleum contamination in the soil, ground water, or both soil and ground water. For discussion purposes, however, we assume that site ground water does not exceed regulatory cleanup criteria. The shallow nature of the site ground water would suggest that this is an unrealistic assumption; however, the distribution of elevated soil vapor readings with respect to the potential sources suggests that vapors are more likely to be associated with soil than ground water. The elevated soil vapor readings appear to be uniformly distributed around the sources rather than elongated in the direction of assumed ground-water flow, as would be expected if the vapors were associated with the ground water. Therefore, because it does not appear that ground water has been adversely impacted, we have limited the following discussion of remedial options to remediation of potentially contaminated soil.

An outline of some options available to AML for addressing future remediation of potentially contaminated soil at the site is provided below. This discussion is based on the following considerations:

- The environmental laws and regulations that are currently in effect in the state of Washington
- The results of the soil vapor survey
- The experience Dames & Moore has had in providing soil remediation systems at other facilities
- The expressed intent of AML to reduce or remove potential environmental hazards at the site.

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Although the extent of soil that exceeds regulatory cleanup criteria is not yet know, we estimate, based on previous similar studies, that the 20 ppm contour (Figure 2) represents the extent of contaminated soil that may exceed regulatory criteria. For the purpose of the following discussion, we have made the following simplifying assumptions:

- The 20 ppm contour represents the extent of soil that exceeds the cleanup criteria contained in the July 27, 1990 amendments to the Washington State Model Toxics Control Act (MTCA).
- All soil within the 20 ppm contour, and between ground surface and the water table, requires remediation. Ground water is estimated to be at a depth of approximately six feet.
- · Ground water contamination is not present.
- The discussion is limited to the potential contamination associated with the existing USTs and does not include the area near the former UST. The discussion is limited to the existing UST area because AML's current focus is to decide how much soil should be excavated at the time the USTs are removed and because the full extent of potential contamination in the area of the former UST has not been delineated.

approaches to soil remediation for the site. The five options are listed below and depicted on Figure 3. Table 2 summarizes the advantages and disadvantages of each option and Table 3 provides estimated ranges of costs associated with the implementation of each option.

Option 1 -

Implementation of this option removes the source of subsurface contamination. It makes the source of subsurface contamination of this option removes the source of subsurface contamination. It makes the source of subsurface contamination of this option removes the source of subsurface contamination. It makes the source of subsurface contamination of this option removes the source of subsurface contamination. It makes the source of subsurface contamination of this option removes the source of subsurface contamination. It makes the source of subsurface contamination of the subsurface con

Option 2 -

Implementation of this option remains the soil that is excavated can either be: a) discussion of b) lands and. Table 3 provides estimated costs for both the disposal and landfarming options.

Option 3 - Remove the USTs; excavate and landfarm soil within the 100 ppm contour; remediate soil between the 20 and 100 ppm contours with *in-situ* remediation techniques, such as soil vapor extraction or bioremediation.

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with long-term techniques. Soil vapor extraction and bioremediation are common remedial techniques for petroleum contamination but they require extended periods of time to achieve cleanup levels. The amount of time that is required depends upon subsurface conditions, such as soil type, and the system design.

# Option 4 - Remove LISTs: excavate all the the 20 ppm contour.

This option removes the source of subsurface contamination and quickly remediates all soil that exceeds regulatory cleanup criteria. As explained for Option 2, the excavated soil could either be disposed or landfarmed. The estimated cost for these lands is

Option 5 - Remove USTs; remediate all soil within the 20 ppm contour with *in-situ* techniques, such as soil vapor extraction or bioremediation.

This option removes the source of subsurface contamination and remediates any contaminated soil with long-term techniques.

These remedial options are provided to illustrate the types of considerations that apply to remediation of a site. The cost estimates are preliminary and are based on the assumed extent of contamination indicated by the soil vapor survey. The estimates do not include the cost associated with AML's management involvement nor interruptions to AML operations.

#### 3.3 SUMMARY AND CONCLUSIONS

Soil vapor surveys were conducted at the AML site near two existing USTs and one former UST. The survey data correlates well with results that would be expected if the former and existing USTs and associated piping have released fuel to the subsurface. The results of the soil vapor survey need to be calibrated with laboratory tests of site soil and ground water so that the extent of soil or ground water that exceeds proposed regulatory cleanup criteria, if any, can be evaluated.

Based on preliminary cost estimates and the potential extent of contaminated soil that is indicated by the soil vapor survey,

#### 3.4 RECOMMENDATIONS

Based on the previous discussions, the results of our soil vapor survey, and our previous experience with similar projects, we recommend the following course of action:

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- b. Conduct a soil and ground-water assessment to provide calibration data for the soil vapor survey, evaluate the potential for ground-water contamination, and collect samples by which *in-situ* remedial techniques can be evaluated.
- c. Based on the results of the soil and ground-water assessment, re-evaluate remedial options for the site.
- d. Select a remedial plan that best addresses the issues of regulatory concerns, cost, future site use, and impact to current site operations.
- e. Report the investigative findings and proposed remedial action plan to the Washington Department of Ecology.
- f. Remove the USTs and implement the remedial action plan.

#### 3.5 LIMITATIONS OF STUDY

Dames & Moore has performed this work, made the findings, and proposed recommendations in accordance with generally accepted environmental science practices in effect in the Seattle, Washington metropolitan area at the time the work was performed. It should be recognized that this study was not intended to be a definitive assessment of contamination at the site, but an evaluation of the potential for contamination. Opinions and recommendations provided herein apply to site conditions existing at the time of our assessment and those conditions which we have been able to reasonably foresee. Opinions and recommendations provided do not necessarily apply to site changes of which this office is not aware and has not had the opportunity to evaluate. It must also be understood that changing circumstances in the environment and in the use of the property can alter the validity of conclusions and information contained in this report. Dames & Moore is not responsible for data obtained from other sources.

## 4.0 REFERENCES

[1] B&C Equipment Company, April 26, 1990, Data Charts for Tank System Tightness Tests.

October 29, 1990

Alaska Marine Lines 5615 W. Marginal Way Seattle, WA 98106

Attn: Mr. Bill Troy

Confirming Agreement Site Assessment 7100 Second Avenue SW Seattle, Washington

Dear Mr. Troy:

This letter is to confirm that we are proceeding under your authorization to evaluate the presence of petroleum in soil and ground water and remedial alternatives for the Alaska Marine Lines (AML) facility located at 7100 Second Avenue SW in Seattle, Washington. A preliminary assessment of this site was conducted by Dames & Moore in September 1990 using a soil vapor survey [1]. During this survey, anomalous soil vapors were detected in a large area of the site; however, the highest concentrations (200-300 ppm) were found in the vicinity of the underground storage tanks. Elevated vapor concentrations (up to 100 ppm) were also detected near an area where an underground gas tank and associated pumps were previously located.

We understand that it is the intent of AML to bring the site into compliance with regulatory requirements. This work plan describes a series of tasks that will evaluate the levels of petroleum products in the soil and ground water and evaluate potential remedial alternatives for the site. Completion of the tasks described in this work plan are expected to yield sufficient information to select an appropriate technique for remediating the site if the site ground water quality has not been impacted. If significant ground water contamination is identified, additional investigative activities may be warranted. We understand that the site is heavily used and remedial actions must be designed to minimize site disruption.

#### OVERALL APPROACH

The soil vapor survey provided preliminary information regarding the potential extent of petroleum in the subsurface, but the information is not sufficient to evaluate the extent of soil or ground water that exceeds proposed cleanup criteria for fuel products. Therefore, the

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initial tasks of this work plan involve defining the concentrations and extent of petroleum at the site.

After the extent of petroleum in the subsurface has been defined, a list of potentially applicable remedial technologies will be developed. These technologies will be evaluated based upon cost effectiveness, implementability, and compliance with environmental regulations. Based upon this evaluation, a remedial alternative will be recommended for implementation.

#### SCOPE OF WORK

We have divided our proposed scope of work into four separate work tasks. A description of the activities that will be performed and the estimated cost for each task is provided below.

Task 1: Install Ground Water Monitoring Wells and Drill Soil Borings

Estimated cost: \$13,000

Dames & Moore will install four ground-water monitoring wells on the AML site. The wells will be drilled to approximately 15 feet below ground surface. The purpose of the wells is to assess the potential for petroleum constituents in ground water and to determine the direction of ground water flow beneath the site. Soil samples will be collected during drilling at depths of 2, 5 and 10 feet below ground surface and screened using an organic vapor monitor (OVM). Ground water samples and selected soil samples will be collected from each well and analyzed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylene (BTEX).

Four soil borings will be also drilled as part of this task. Each boring will be placed near a former soil vapor probe location. Soil samples will be collected from these borings and field screened for organic vapors using the OVM. Selected samples will be submitted for laboratory analysis of TPH and BETX. The lab results will be correlated, if possible, to the soil vapor readings. This correlation will be used to estimate TPH/BTEX concentrations in other areas of the site.

In order to assess the vertical profile of the petroleum contamination, three samples will be collected from each boring at depths of approximately 2, 5 and 10 feet below ground

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Task 2:

Estimate area and volume of soil requiring remediation and identify

candidate remedial technologies

**Estimated Cost:** 

\$5,000

Based on the data collected in Task 1, Dames & Moore will evaluate the correlation between the soil vapor readings (obtained in September) and the results of analytical testing. If a linear correlation exists between the two sets of data, we will calculate the volume of soil that requires remediation. A list of candidate technologies will also be developed as part of this task. Based on current information on the site, we anticipate including excavation with off-site disposal, land farming, soil vapor extraction and bioremediation as candidate technologies. Any additional field data necessary to evaluate the candidate technologies will be collected during this task. For budgetary purposes we have assumed a soil vapor extraction pilot test will be needed.

Task 3: Evaluation of Candidate Technologies

Estimated cost: \$3,000

Candidate technologies will be evaluated for cost effectiveness, implementability and compliance with environmental regulations. To evaluate cost effectiveness, rough cost estimates will be prepared for each candidate technology. Both capital and operating and maintenance costs will be estimated. The implementability criteria will include the impact of the technology on current site activities, the time required to implement the technology and the general complexity of the technology. In evaluating the technology for compliance with environmental regulations, we will consider proposed clean-up standards contained in the Model Toxics Control Act as well as proposed state ground water quality standards.

Task 4: Prepare Report

Estimated Cost: \$5,000

Dames & Moore will prepare a report documenting the work performed and the results of our studies. The report will evaluate the potential extent of any identified contamination and recommendations for additional study, if required, and remedial actions if possible. Estimated costs and implementation schedules for any proposed work will also be provided.

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Task 4:

Prepare Report

**Estimated Cost:** 

\$5,000

Dames & Moore will prepare a report documenting the work performed and the results of our studies. The report will evaluate the potential extent of any identified contamination and recommendations for additional study, if required, and remedial actions if possible. Estimated costs and implementation schedules for any proposed work will also be provided.

The total estimated cost for Tasks 1 through 4 is \$26,000. Actual cost for the work will depend upon conditions encountered in the field at the time the work is conducted.

This work will be conducted in accordance with the terms and conditions of the Service Agreement between Alaska Marine Lines and Dames & Moore dated June 1, 1990. If you have any questions concerning our scope of work, please call at your convenience.

Very truly yours,

**DAMES & MOORE** 

Swan C. Kent

Susan C. Kent Project Manager

Wanda Schulze Project Engineer

cc: Bob Strong, Lynden Inc.

#### References

[1] Dames & Moore, September 1990, Report of Soil Vapor Survey, 7100 Second Avenue SW, Seattle, Washington, prepared for Alaska Marine Lines8/

TABLE 1 SOIL VAPOR MEASUREMENTS ALASKA MARINE LINES SEATTLE, WASHINGTON

PROBE LOCATION	PROBE DEPTH (feet)	TIME (actual)	SOIL VAPOR READINGS (ppm)	MAXIMUM (ppm)
001	2	1043 1044 1045 1046	3.5 3.5 5.3 5.0	5
002	4	1051 1052 1053	8.2 8.0 8.3	. 8
001	6	1101 1102 1103	3.4 3.3 3.5	3
002	2 4	1131 1132 1133 1137	85 83 90 95	95
002	4	1148 1149 1150	105 107 106	107
003	2	1141 1142 1143	12.0 16.2 30.2	30
004	2	1211 1212 1213	9.4 9.9 9.6	10
005	2	1221 1222 1223	7.3 7.4 7.4	7
006	2	1234 1235 1236	76.5 77.8 80.0	80

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PROBE LOCATION	PROBE DEPTH (feet)	TIME (actual)	SOIL VAPOR READINGS (ppm)	MAXIMUM (ppm)
007	2	1413	212	272
		1414	202	
		1415	271	
		1416	272	
008	2	1508	245	248
		1509	245	
		1510	248	
009	2	1429	67.4	67
		1430	66.5	
		1431	66.8	
010	2	1436	68.2	73
		1437	72.6	
		1438	73.5	
011	2	1442	140	145
		1443	143	
		1444	145	
012	2	1517	48.0	49
		1518	49.2	
		1519	48.7	
013	2	1530	43.1	44
		1531	43.5	
		1532	44.2	
014	2	1536	42.9	43
		1537	42.6	
		1538	43.0	
015	2	1601	65.8	67
		1602	65.3	
		1603	66.6	
016	2	1607	20.0	22
		1608	21.8	
		1609	21.8	
017	2	1613	17.6	· 20
		1614	17.1	
		1615	19.6	

D-008-[-]-005/akmarine.tbl

PROBE LOCATION	PROBE DEPTH (feet)	TIME (actual)	SOIL VAPOR READINGS (ppm)	MAXIMUM (ppm)
018	2	1620 1622 1623	5.6 5.3 5.5	6
019	2	1643 1645 1646	143 145 146	146
020	2	1652 1653 1654	351 365 368	368
021	2	1704 1705 1706	8.6 7.0 6.2	9
022	2	0932 0933 0935	98.2 99.0 99.8	100
023	2	0948 0949 0950	10.1 8.6 8.1	10
024	2	1002 1003 1004 1005	36.0 37.1 37.8 37.7	38
025	2	1045 1046 1047	35 38 40	40
026	. 2	1108 1109 1110	10.8 11.1 10.4	11
027	1	1133 1134 1135	8.5 9.1 9.6	10
028	2	1200 1201 1202	1.8 2.1 2.2	. 2

PROBE LOCATION	PROBE DEPTH (feet)	TIME (actual)	SOIL VAPOR READINGS (ppm)	MAXIMUM (ppm)
029	2	1450	62	65
		1451	65	
		1452	65	
030	2	1507	41	42
		1512	42	
		1513	42	
031	2	1529	82	84
		1530	84	
		1531	83	
032	2	1558	27	30
		1559	29	
		1600	30	

# TABLE 2 ADVANTAGES AND DISADVANTAGES OF REMEDIAL OPTIONS ALASKA MARINE LINES SEATTLE, WASHINGTON

#### **ALTERNATIVE ADVANTAGES DISADVANTAGES** 1. Removes source of contamination. Least disruption to site activities. Removes source of 2. contamination. Removes worst of contaminated soil. Could be planned for minimal interruption to site activities. 3. Remove USTs; Achieves regulatory Requires long-term excavate soil compliance. commitment to within 100 ppm Quickly removes remedial effort. contour; remediate worst of the soil within 20 and contaminated soil. 100 ppm contours with in-situ techniques. Remove USTs; Achieves regulatory Expensive. excavate soil compliance. within 20 ppm Quick solution. contour. 5.

# TABLE 3 ESTIMATE COST RANGES REMEDIAL OPTIONS ALASKA MARINE LINES

	LINE	OPTION
	TOTALS	TOTALS
	(x \$1,000)	(x \$1,000)
CONTION 1		
Remove USTs	\$17	
Engineering	\$3-5	
4465.75		
Remove USTs	\$17	
a) Excavate/dispose soil		
within 100 ppm contour	\$135-155	
b) Excavate/landfarm soil		
within 100 ppm contour	\$55-75	
Engineering	\$5-15	a) 157-187
		b) 77-107
OPTION 3		
Remove USTs	\$17	
Excavate/landfarm soil within	<b>41</b> 7	
100 ppm contour	\$55-75	
Remediate soil in-situ within	\$33.3	
20-100 ppm contour		
Investigative costs	\$25-50	
Remedial costs	\$40-70	\$137-212
OPTION 4		
Remove USTs	\$17	
a) Excavate/dispose soil within		
20 ppm contour	\$400-500	
b) Excavate/landfarm soil within		
20 ppm contour	\$150-170	
Engineering	\$15-50	a) \$432-567
		b) \$182-237
OPTION 5		*
Remove USTs	\$17	
Remediate soil in-situ	Ψ1,	
Investigative costs	\$25-50	
Remedial costs	\$40-70	\$82-137
-	<b>4.0.</b>	402 131

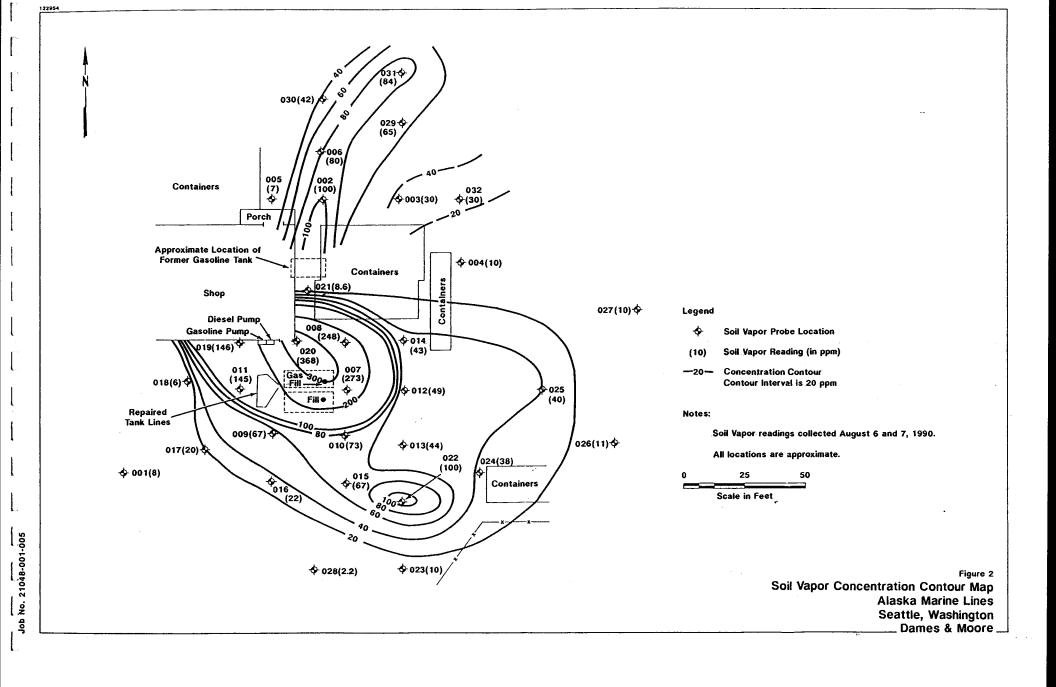
## ASSUMPTIONS FOR ESTIMATING REMEDIAL COSTS:

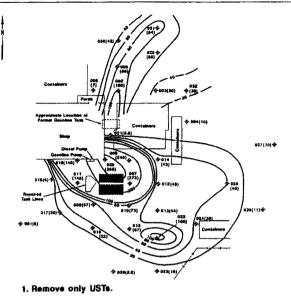
- The estimated costs on Table 2 are provided to AML only for budgetary planning purposes and are based on our experience with investigations and remediations at other similar sites. These estimates are not intended as a bid or proposal from Dames & Moore, nor are they intended to accurately represent actual costs that may be incurred during the course of remediation at the AML site. The extent of remediation that may be required at the site remains to be evaluated, and until such an evaluation has been completed, any costing is preliminary in nature. These numbers are provided as a service to AML to convey the types of options and considerations that AML will face at some point in the future.
- 2. The 20 ppm contour illustrated on Figure 2 is assumed to represent the extent of soil that exceeds the cleanup criteria contained in the July 27, 1990 ammendments to the Washington State Model Toxics Control Act (MTCA). This assumption is made for discussion purposes only and is not intended to suggest that the extent of soil that exceeds MTCA criteria is actually represented by the 20 ppm contour.
- 3. Our calculations assume that all soil within the 20 ppm contour, and between ground surface and the water table, requires remediation and that ground water is present at a depth of approximately six feet. These assumptions are made for calculation pruposes only and are not based on supporting data.
- 4. Ground-water contamination is assumed to not be present. Ground-water quality data for the site are not available at this time, but this assumption has been made to limit the discussion of remedial options.
- 5. Only the area near the existing USTs is included in the cost estimates. The apparent extent of anomalous soil near the former UST tank is not fully delineated, and hence it is difficult to quantify estimated costs for that area at this time.
- 6. The cost for removing the existing tanks was previously provided to AML by another contractor.
- 7. Engineering costs are estimated to be a minimum of \$3,000 or ten percent of total contractor cost, whichever is greater.
- 8. The area within the 20 ppm contour was calculated to contain approximately 2,800 cubic yards (cy). Assuming 1.5 tons/cy, this area was calculated to contain approximately 4,200 tons of soil. The area within the 100 ppm contour was calculated to contain 830 cy (1,250 tons) of soil.
- 9. Specific unit costs used in the calculations include:

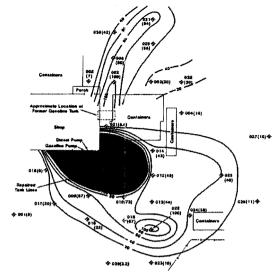
Excavation: \$10/cy

Backfill: \$6/cy Transport: \$10/ton Paving: \$1.20/sf Disposal: \$80/ton 10. In-situ techniques are long-term efforts that can require between one and 30 years for completion. The estimated remedial costs provided in Table 3 do not include operational and maintenance costs associated with long-term monitoring of in-situ remedial systems.

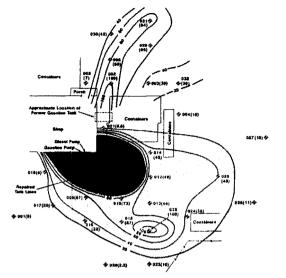
Joh No. 21048-001-005



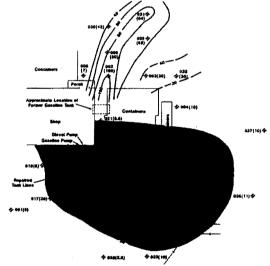




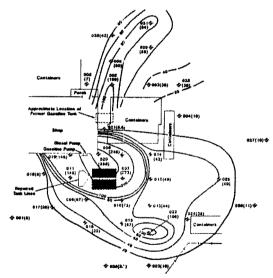
2. Remove USTs and soil within 100 ppm contour.



3. Remove USTs and soil within 100 ppm contour; remediate soll within 20 and 100 ppm contours with in situ techniques.



4. Excavate USTs and soll within 20 ppm contour.



5. Excavate USTs and remediate soll with in situ techniques.

LEGEND:

Excavation Area

ky situ Remediation Area

Figure 3 Remedial Options Alaska Marine Lines Seattle, WA

Dames & Moore \_\_\_

February 26, 1991

Mr. Bill Troy Alaska Marine Lines 5615 West Marginal Way SW Seattle, WA 98106

Draft Report
UST Closure
7100 Second Avenue
Seattle, Washington

Dear Mr. Troy:

Transmitted herein are two copies of the subject report for your review. If you have any questions or comments concerning the draft report, please call at your convenience. After we have received your review, we will issue a final report.

Yours very truly,

DAMES & MOORE

wa C. Kut

Susan C. Kent Project Manager

cc: Bob Strong (Lynden, Inc.), two copies

C-012-005\AML-1110.RWP 21048-001-005

February 26, 1991

Mr. Bill Troy Alaska Marine Lines 7100 2nd Avenue SW, Seattle, Washington 98106

> Draft UST Closure Report 7100 2nd Avenue SW Seattle, Washington

Dear Mr. Troy:

This report documents the permanent closure of two underground storage tanks (USTs) located at the above referenced site.

#### BACKGROUND

Two USTs of unknown age were located in a single excavation zone at the project site: one 10,000-gallon diesel UST and one 10,000-gallon gasoline UST. Both of these tanks were reported to have failed integrity tests that were conducted in April 1990 [1]. The results of a soil vapor survey conducted by Dames & Moore in September 1990 [2] suggested that leakage of petroleum products may have occurred from the USTs and/or associated piping; however, the extent of potentially contaminated soil and/or ground water was not evaluated.

A soil and ground water assessment was performed between October and December 1990. The results of that work [3] identified only a limited amount of petroleum hydrocarbons in the subsurface that is directly associated with the two UST's.

It is the intent of AML to bring the USTs and their site into compliance with existing regulatory requirements for USTs. AML has removed the USTs and plans to remediate any soil or ground water that poses unacceptable risk to human health or the environment.

#### **PURPOSE**

The purpose of this assessment was to document UST closure and to evaluate the potential presence of fuel constituents in soil and ground water during the removal of the USTs. This assessment is required under federal and state regulations. The general procedures for the contamination assessment are outlined in the following:

Code of Federal Regulations, "Technical Standards and Corrective Action Requirements For Owners and Operators of Underground Storage Tanks," 40 CFR, Subpart G, Section 280.72.

Washington Administrative Code, "Proposed Underground Storage Tank Regulations," dated August 1, 1990, WAC 173-360-390.

#### SCOPE OF WORK

The principal tasks completed by Dames & Moore during the assessment are listed below:

- Observed the excavation of a 10,000-gallon diesel UST and a 10,000-gallon gasoline UST, hereinafter referred to as Tanks 1 & 2, respectively. The two USTs were located in a single excavation zone south of the refrigeration (refer) shop (Figure 1).
- 2. Submitted one soil sample, (SS-1) collected from the bottom of the excavation zone for laboratory analysis of total petroleum hydrocarbons (TPH).

#### TANK CLOSURE ACTIVITIES

On January 24, 1991, Dames & Moore oversaw the removal of two USTs by B & C Construction (B & C). B & C began closure activities by disassembling the pump dispensers and demolishing the asphalt and concrete paving covering the tops of Tanks 1 & 2 with a hydrohammer. Following the removal of the paving with a trackhoe, the asphalt and concrete was loaded into a dumptruck and removed from site. The paving is reported to have been disposed of at Coal Creek Landfill. Once the paving was removed, Northwest Envirofield Services (NWES) pumped and rinsed the remaining product from the tanks. The pump and rinse certificate is provided as Attachment A. Soil was then excavated and the tops of Tanks 1 & 2 were exposed. The tanks were approximately four feet below top of asphalt (TOA) and the spacing between the tanks was approximately three feet. All soil removed from the tank excavation zone was stored on asphalt paving surrounding the perimeter of the excavation zone.

On January 25, 1991, B & C inerted Tanks I & 2 with CO2 (dry ice). Lieutenant VanTrojen, with the Seattle Fire Department, witnessed the inertion. After receiving approval from the Fire Marshall, the tanks were removed and a visual inspection of the tanks revealed minor pitting and corrosion, no cracks or holes were observed. B & C Construction transported the tanks by flatbed to their facilities. The Tank Disposal Receipt is provided as Attachment B. After the removal of the tanks, excavation dimensions were approximately twenty feet wide by thirty-five feet long and approximately fifteen feet deep.

One soil sample (SS-1) was collected from the bottom of the excavation zone and only SS-1 was submitted for laboratory analysis of total petroleum hydrocarbons (TPH) by Modified EPA Method 8015. All excavated soil was returned to the excavation and compacted. Filter fabric was placed over the backfill and approximately seven vertical feet (195 cubic yards) of crushed rock was placed on top of the filter fabric. The excavation zone is to be resurfaced at a later time.

#### SOIL AND GROUND WATER ASSESSMENT

Figure 2 illustrates the subsurface conditions near the UST excavation zone. In the tank excavation zone, the backfill material consisted of fine to medium sand. Around the perimeter of the excavation zone, the soil lithology consisted of an upper three feet of fine to medium sand underlain by approximately two feet of silty sandy clay. Fine sand underlaid the layer of silty sand. Ground water was not encountered during excavation activities.

Excavated soil was visually stained from light grey to black and emitted strong petroleum odors. A petroleum sheen was present on the soil within the excavation zone at a depth of approximately fourteen feet.

The analytical report for the soil sample is included as Attachment C. The results indicate that the soil in the excavation zone area does not exceed the proposed cleanup levels for petroleum fuel constituents contained in the Model Toxics Control Act Amendments dated February 28, 1991 (MTCA). Additional soil samples were not collected at the time of

excavation due to the extensive soil and ground water sampling which was performed prior to the removal of the two UST's [3].

#### SUMMARY AND RECOMMENDATIONS

A 10,000-gallon diesel UST and a 10,000-gallon gasoline UST have been removed from the AML site along with piping and ancillary equipment. Ground-water was not encountered during the excavation activities. The excavation has been backfilled and compacted. Analytical results indicate that the TPH levels in soil do not exceed the newly established MTCA cleanup levels for TPH. It should be noted that federal regulations require the site owner and/or operator to retain this report and that it should be available for review for a minimum of three years.

#### CONCLUDING REMARKS

Dames & Moore has performed this work, made the findings, and proposed the recommendations described in this report in accordance with generally accepted environmental science practices in effect at the time the work was performed. Opinions and recommendations provided herein apply to site conditions existing at the time of our assessment and those conditions which we have been able to reasonably foresee. Opinions and recommendations provided do not necessarily apply to site changes of which this office is not aware and has not had the opportunity to evaluate. It must also be understood that changing circumstances in the environment and in the use of the property can alter the validity of conclusions and information contained in this report.

It is a pleasure to continue our services for Alaska Marine Lines. If you have any questions concerning this project, or if we can be of further assistance, please do not hesitate to call.

Sincerely,

Dames & Moore
Mack a. Chandler

Mark A. Chandler
Project Geologist

Susan C. Kent Project Manager

#### Attachments

Figure 1
Figure 2
Pump and Rinse Certificate
Certificate of Tank Disposal
Analytical Results

#### REFERENCES

- [1] B & C Equipment Company, April 26, 1990, Data Charts for Tank System Tightness Tests.
- [2] Dames & Moore, September 25, 1990, Report of Soil Vapor Survey, 7100 Second Avenue, Seattle, Washington.
- [3] Dames & Moore, In Progress, Soil and Ground Water Assessment, 7100 Second Avenue, Seattle, Washington.

# ATTACHMENT A

## PUMP AND RINSE CERTIFICATE



# PUMP AND MINSE CENTIFICATION

DATE: / - 21/-9/	32-21048
TO WHOM IT MAY CONCERN	
This letter is to certify that tank(s), size(s)	
2) 10,000 Diesel	
have been pumped and rinsed for removal.	
Work was performed at:	
7100 2Nd SW	
5 Enthe WA	
For: Z. N.C.	The second secon
Please note that this letter does not certify that the above tank(s) have been that it (they) should be considered gas-free	en cleaned for disposal cr
Sincerely, 32-21048	
Northwest EnviroService, Inc.	

Underground Tank Division 762-1190

# ATTACHMENT B CERTIFICATE OF TANK DISPOSAL

\*



# B & C EQUIPMENT CO.

SERVICE STATION & RELATED EQUIPMENT—SALES & SERVICE

19009 16TH AVE., S. • SEATTLE, WA 98188 • (206) 433-1015

# CERTIFICATION OF TANK DISPOSAL

DATE: 2-55	. 91	
	CH REMOVED: Lived	
7100 Second	AVI S.W. SenTILE	, uk
QUANTITY	SIZE	LAST KNOWN PRODUCT
0/	10,000 GAI	GAS process
**************************************		
TRANSPORT DRIVER:	John P.Cl.	ARK
	ARD: Scattle Scro	•
RECEIVED BY:	JOSEAN BALLE	106



#### **B&C EQUIPMENT CO**

### SERVICE STATION & RELATED EQUIPMENT - SALES & SERVICE

19009 16TH AVE. S. SEATTLE, WA 96188 (206) 433-1015 FAX (206) 248-2531

CERTIFICATION OF TANK DISPOSAL

DATE: 2/6/9/		
LOCATION FROM WHICH REM	MOVED: #/301	lynden
QUANTITY	SIZE	LAST KNOWN PRODUCT
	10,000 ggl	Diesel
Control of the Control of Control of the Control of Con		**************************************
TRANSPORT DRIVER:	ohn (lazk	
RECEIVING SCRAP YARD:	Ielmon Be	mysteel-Kent
RECEIVED BY:	Priam	
	1 Neuest	neutr

### ATTACHMENT C ANALYTICAL RESULTS



February 8, 1991

Dames & Moore Attn: Sue Kent 500 Market Place Tower 2025 1st Avenue Seattle, WA 98121

INRE: ALDEN PROJECT NUMBER 9101018/1

Dear Sue:

Enclosed are the analytical results for the soil samples submitted to Alden Labs January 28, 1991. The samples were analyzed for TEPH using Method 8015-Modified, Pentachlorophenol using Method 8270 and Total Arsenic. The inorganic analysis was performed by Sound Analytical Labs. A hard copy or thier report is included.

It is Alden's policy to dispose of samples two weeks after the report date, unless otherwise noted. If you have any questions please feel free to call me.

Sincerely,

John M. Buerger Laboratory Manager

**Enclosures** 



### REPORT OF ANALYTICAL RESULTS

Client: Dames & Moore

Client Sample Number: See below Date of Sample Receipt: 1/28/91

Matrix: Soil

Alden Job Number: 9101018/1

Alden Sample Number: See below Analysis Method: 8015-Modified

Reporting Units: mg/kg

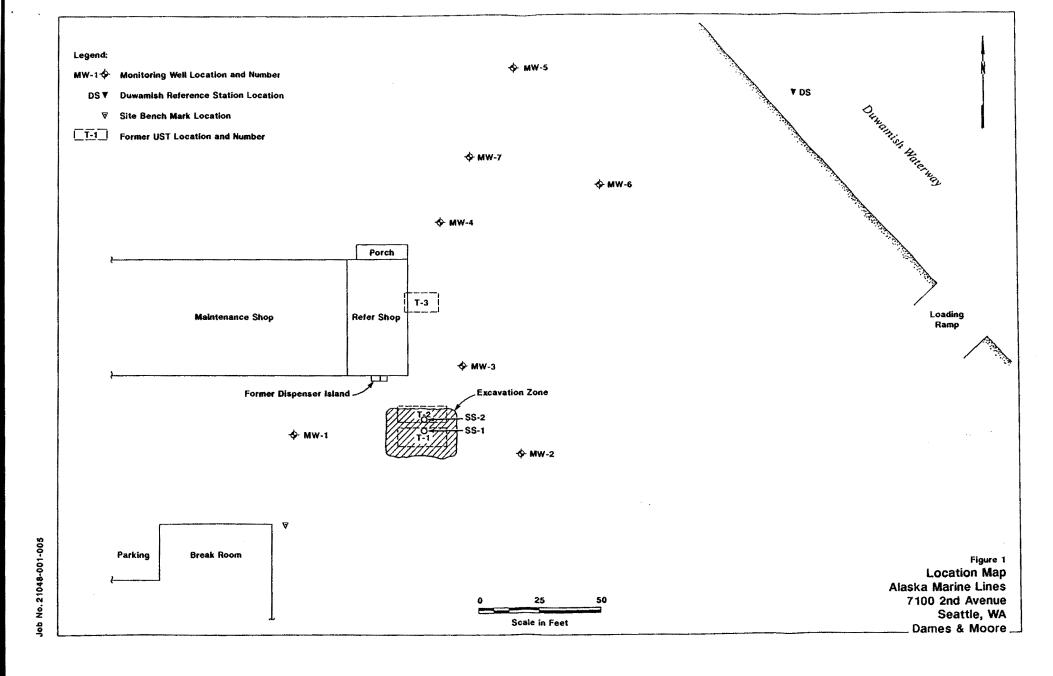
Client <u>Sample ID</u>	Alden Sample Number	Extraction Date	Analysis Date	Total Extractable Hydrocarbons
NA	Blank	1/30/91	2/7/91	< 2.0
SS-1	<b>6388</b>	1/30/91	2/7/91	<b>9</b> 5
SS-1	6388RE	2/14/91	2/20/91	120

Note: Results are reported to two significant figures.



DATE /2/4 PAGE LOF L

Chain of Custody LABORATORY NUMBER: 560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335 PROJECT MANAGER: SUE KENT **ANALYSIS REQUEST** ADDRESS: 2025 1 ST AVE TOLPONLY Phosphate Pesticide NUMBER OF CONTAINERS Aromatic Volatiles EP TOX Metals (8) EP Seattle, WA SAMPLED BY: M. Chandle SAMPLE DISPOSAL INSTRUCTIONS ATI Disposal @ \$5.00 each ☐ Return 9010 9020 MATRIX LABID DATE SAMPLE ID SoiL 1-25-91 PM 55-1 RELINQUISHED BY: 1. RELINQUISHED BY: 2. RELINQUISHED BY: 3 SAMPLE RECEIPT PROJECT INFORMATION Time: Signature: Time: Signature: Time: Signature: PROJECT NUMBER: 2/048-00/ TOTAL NUMBER OF CONTAINERS PROJECT NAME: AML -ShipyALD COC SEALS/INTACT? Y/N/NA Printed Name: Date: Printed Name: Date: PURCHASE ORDER NUMBER: RECEIVED GOOD COND/COLD B. Graham 1/20/41 NO 🗆 RECEIVED VIA: ONGOING PROJECT? YES 🔯 📉 Company: Company: **PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS** RECEIVED BY: (LAB) RECEIVED BY: 1. RECEIVED BY: 3. TAT: (NORMAL) 2 2WKS ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK (RUSH) Time: Signature: Time: Signature: Time: Signature: GREATER THAN 24 HR. NOTICE? № П YES 🗂 (LAB USE ONLY) SPECIAL INSTRUCTIONS: Printed Name: Date: Printed Name: Date: Printed Name: Date: Analytical Technologies, Inc. Company: Company:



REPORT SOIL AND GROUND-WATER ASSESSMENT 7100 SECOND AVENUE SOUTHWEST SEATTLE, WASHINGTON

**Prepared For** 

ALASKA MARINE LINES JOB NO. 21048-001-005 March 6, 1991



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#### **EXECUTIVE SUMMARY**

This report documents the activities and findings of a soil and ground-water assessment conducted by Dames & Moore for Alaska Marine Lines (AML) at its facility located at 7100 Second Avenue, Seattle, Washington. The objective for the study was to evaluate the nature and extent of petroleum constituents in the subsurface associated with underground storage tanks (USTs). The approach to the project was to review historical records concerning site use and to conduct a field assessment to collect and analyze soil and ground-water samples. The work has been conducted in accordance with the Model Toxics Control Act Cleanup Regulation effective February 28, 1991 (MTCA).

The activities that were performed in support of this project include the following:

- · Alaska Marine Lines records and other historical sources were reviewed;
- · Thirteen soil borings were drilled;
- Seven ground-water monitoring wells were installed, developed, and sampled;
- · One soil vapor extraction test well was installed;
- Twenty-nine soil samples were collected and analyzed by a certified laboratory;
- · Water levels were measured in the wells and the Duwamish Waterway.

The principal findings and conclusions from this assessment are summarized below.

#### Site Development and Use

- The site was part of a turning basin in the Duwamish River until sometime between 1958 and 1966. Since that time, the principal site uses have included a ready-mix concrete plant for an unknown length of time before 1977, school bus maintenance by Laidlaw Company between 1978 and 1982, and barge loading by AML since 1984.
- Buried waste oil tanks were apparently installed by Laidlaw, but their locations, if still
  on site, are not known. Laidlaw also installed a gasoline UST that was removed around
  1984. AML installed a 10,000-gallon diesel UST and 10,000-gallon gasoline UST in
  1984 which were recently removed in January 1991.

#### Nature and Extent of Petroleum in Soil

- Oil is the principal hydrocarbon present in the soil and concentrations up to 3,600 mg/kg (measured as total petroleum hydrocarbons, TPH) were identified. The vertical depth of the oil occurrence is at least 30 feet in two areas of the site and undefined in other areas of the site. The lateral extent appears to exceed an area of approximately 150 by 150 feet.
- Although the source of the oil is not known, it is believed to be associated with historical activities performed at the site or on adjoining sites. These historical activities

include disposal of oil into the Duwamish by Northwest Cooperage during World War II, waste oil disposal by Laidlaw between 1978 and 1982, and backfilling of the site during its development. The available data is most consistent with oil disposal by Northwest Cooperage; however, further work would be required to determine the source of the oil.

- If the source of the oil is from historical waste disposal in the Duwamish, the oil has weathered for over 50 years, and the product that remains in the ground at this time could be expected to be a residual material that appears stable in the subsurface environment. This hypothesis is supported by the presence of relatively high TPH concentrations in soil below the water table (up to 3,600 mg/kg) and low TPH levels in the ground water (less than 0.59 mg/L).
- Gasoline components benzene, toluene, ethylbenzene, and xylene (BTEX) were largely non-detectable in the soil except in samples collected near tank T-2. The BTEX levels that have been identified do not exceed MTCA cleanup criteria.

#### Nature and Extent of Petroleum in Ground-Water

- Ground-water samples contained only low TPH values (less than 0.59 mg/L), which are below the proposed MTCA criteria for TPH in ground water (1 mg/L).
- BTEX has only been detected in ground-water samples from monitoring wells MW-3 and MW-4. The available data suggests that only limited migration of BTEX in ground water has occurred.
- The most likely source of BTEX in ground-water are the former site gasoline USTs.
- The BTEX concentrations in samples collected from monitoring well MW-3 increased between sampling events performed in October and December. This may suggest that either equilibrium conditions were impacted during drilling and monitoring well installation, or that BTEX concentrations fluctuate in the subsurface due to tidal or other site-specific causes.
- There is no evidence that the Duwamish Waterway is being impacted by possible fuel releases from the site's USTs or the presence of weathered oil in the soil. The wells closest to the Duwamish Waterway contained no detectable concentrations of BTEX.

#### Remedial Evaluation

 Remedial alternatives for treating or removing the TPH in soil, such as vapor extraction, fixation, and containment, could be expected to be largely ineffective at this site because of the apparently residual nature of the original oily material. Because of the apparent extent and depth of the TPH, excavation would be unduly costly relative to the limited, if any, reduction in risk to human health and the environment that could be achieved.

 The relatively small amount of BTEX migration that has occurred in site ground-water suggests that ground-water flow rates are low or that biodegradation is naturally removing BTEX from the ground-water. Additional data is required to evaluate the need for ground-water remediation.

#### Recommendations

- Provide this report to WDOE to meet MTCA reporting requirements.
- Conduct quarterly ground-water sampling and water level monitoring for a minimum of
  one year to provide data for the evaluation of such parameters as: seasonal variations in
  ground-water levels and flow rates, on-site hydrogeology, and petroleum mobility. At
  the conclusion of the one-year quarterly monitoring program, the need for additional
  action should be evaluated.

#### 1.0 INTRODUCTION

This report documents the activities and findings of a site assessment performed by Dames & Moore for Alaska Marine Lines (AML) at its facility located at 7100 Second Avenue, Seattle, Washington (Figure 1). The work has been conducted at the request of AML to help them achieve compliance with state, federal, and local regulations concerning underground storage tanks (USTs).

#### 1.1 BACKGROUND INFORMATION

The AML site is a barge loading facility where cargo and refrigerated containers are transferred between barges and trucks. The site is roughly triangular in shape and is bounded on the northeast by the Duwamish Waterway, on the south by a slough and Northwest Cooperage, and on the west by off and on ramps for the First Avenue Bridge. The site is relatively level and entirely paved.

Two USTs, a 10,000-gallon diesel (tank T-1) and a 10,000-gallon gasoline (tank T-2), failed tank integrity tests performed in April 1990. Based on the UST integrity test results, AML elected to remove the tanks and establish above-ground fueling capabilities. Because the site is heavily used, it was AML's goal to minimize disruption to site activities during the excavation of the USTs. In an effort to minimize disruption to the site, Dames & Moore designed and implemented a program to evaluate the nature and extent of petroleum constituents in the site soil and ground water before the USTs were removed. The program consisted of an initial soil vapor survey, followed by a soil and ground-water assessment.

Another gasoline UST (tank T-3), formerly located in an area north of tanks T-1 and T-2, was removed at the time AML acquired possession of the property (1984). It is reported to have served approximately five fuel pumps located in a line north of tank T-3. This area was also assessed during this study.

In September 1990, Dames & Moore performed a soil vapor survey (Dames & Moore, 1990) near tanks T-1, T-2, and T-3. The results of the survey appeared to correlate well with results that would be expected if the USTs and associated piping had released fuel to the subsurface.

Between October and December 1990, a soil and ground-water assessment was performed to evaluate the nature and extent of petroleum constituents in the subsurface in the areas of the USTs. This report documents the activities and findings of that assessment.

In January 1991, the diesel and gasoline USTs were removed and a closure report prepared (Dames & Moore, 1991). A soil sample collected from below the USTs contained 95 mg/kg TPH (Dames & Moore, 1991). Additional sampling was not conducted at the time of the UST closures because of the extensive sampling and analysis that had been completed for the site assessment described in this report.

#### 1.2 PROJECT OBJECTIVES AND APPROACH

The overall purpose of this project was to evaluate the potential presence of petroleum hydrocarbons in the site's subsurface. The approach to the project was to review historical data and collect and analyze soil and ground-water samples for petroleum constituents.

#### 1.3 LIMITATIONS OF STUDY

This report has been prepared in accordance with generally accepted engineering practices. We are confident that the conclusions and recommendations provided in this report are reasonable and appropriate based on the available data; however, we cannot guarantee that all applicable data has been incorporated into our findings. The findings and recommendations provided in this report are our professional opinion and are not a warranty, guarantee, or positive assertion as to the presence, absence, or extent of site contamination or to the nature of site hydrogeological conditions. It should be recognized that this study was not intended to be a definitive assessment of site conditions, but an evaluation of the potential conditions. Opinions and recommendations provided do not necessarily apply to site changes of which this office is not aware and has not had the opportunity to evaluate. It must also be understood that changing circumstances in the environment and in the use of the property can alter the validity of conclusions and information contained in this report. Dames & Moore is not responsible for data obtained from other sources.

#### 2.0 SITE HISTORY

Several sources of historical information have been reviewed to form a brief history of the site and its use. Table 1 provides a chronological summary of the records that have been reviewed.

Prior to 1958, the site was part of a turning basin in the Duwamish Waterway. A 1949 U.S. Geological Survey topographic map for this area (Figure 2) illustrates the relative positions of the site and the old turning basin. Sometime between 1958 and 1966, the turning basin was filled. The site appears to have been used for barge loading since as early as 1971 and it was occupied for an unknown length of time by a ready-mix concrete plant prior to 1977. It was used for school bus maintenance by Laidlaw Company between 1978 and 1981/82. AML has been onsite since early 1984.

Company files belonging to Lynden, Inc. suggest that underground waste oil tanks were installed by the bus company, but their current locations, if still present, are not known. The gasoline tank (tank T-3) was also probably installed by the bus company, but its size and installation date is not known. It was removed when AML moved onto the site in 1984.

Based on the results obtained from the site assessment described in the following sections of this report, additional data was obtained concerning Northwest Cooperage, a property that neighbors AML on the south. Northwest Cooperage is a drum cleaning and recycling facility that has operated at its present location since the early 1940s (U.S. EPA, 1988). Mr. Bob Miller, President of Bowhead Equipment, reports that during World War II, Northwest Cooperage received drums of oil from the U.S. Navy which were disposed by dumping the oil into the Duwamish River near the present location of the AML site. This information bears directly on the findings obtained during this site assessment. The potential significance of this information is discussed in Section 5.0 of this report.

#### 3.0 FIELD ACTIVITIES AND PROCEDURES

This section describes the field activities and procedures that have been performed for the soil and ground-water assessment. The field program was performed in two phases. The first phase was conducted between October 25 and November 1, 1990 and is referred to in this report as the preliminary assessment. The second phase of work, referred to in this report as the followup assessment, was performed between December 6 and 18, 1990. The activities and procedures of the two field phases are discussed together in the following sections.

The field activities that have been performed in support of the soil and ground-water assessment include the following:

- · Thirteen soil borings have been drilled;
- · Seven ground-water monitoring wells have been installed, developed, and sampled;
- · One soil vapor extraction test well has been installed;
- Twenty-nine soil samples have been collected and analyzed by a certified laboratory;
- · Water levels have been measured in the wells and the Duwamish Waterway.

These activities, and the general procedures that were followed during their performance, are described in Sections 3.1 through 3.8.

#### 3.1 DRILLING, SOIL SAMPLING, AND MONITORING WELL INSTALLATIONS

Thirteen soil borings were drilled, seven of which were completed as ground-water monitoring wells (MW-1 through MW-7) and one as a vapor extraction test well (SG-1), at the locations illustrated on Figure 3. The purpose for drilling each of these boreholes is as follows:

- Soil borings SB-1 through SB-4 were drilled for the purpose of collecting and analyzing soil samples to help evaluate the horizontal extent of total petroleum hydrocarbons (TPH) in site soils.
- Soil borings SB-4 and SB-5 were drilled to evaluate the depth of petroleum products near the USTs.
- Monitoring wells MW-1 through MW-3 were installed to evaluate the impact of potential leakage from tanks T-1 and T-2 on ground-water quality.

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- Monitoring wells MW-3 through MW-7 were installed to evaluate the impact of
  potential leakage from tank T-3 on ground-water quality. Monitoring wells MW-5 and
  MW-6, originally sited adjacent to the Duwamish Waterway, were placed approximately
  60 feet inland. This was necessary because concrete was encountered at depth in
  borehole locations that were drilled adjacent to the waterway.
- An eighth monitoring well was originally planned for installation west of monitoring
  well MW-7. Drilling of this well was attempted at three locations, but it was not
  possible to advance and complete drill holes because concrete was encountered at depth
  in each location.

Drilling augers were cleaned with a high-pressure steam cleaner between each borehole location to minimize the potential for cross-contamination. Soil sampling equipment was washed with a water and Alconox solution and rinsed with clean tap water between samples. Soil sampling rings were rinsed an additional time with distilled water.

Drilling was performed by Geoboring and Development Company, Inc. using a hollow-stem auger drilling rig. Boreholes were drilled to depths between 12 and 34 feet using six-inch diameter augers for soil borings and two-inch monitoring wells and 12-inch-diameter augers for four-inch monitoring wells. Relatively undisturbed soil samples were collected at approximately five-feet intervals using split-spoon samplers equipped with three, six-inch-long brass sampling rings that were either 1.5 or 2 inches in diameter. Upon retrieval, one sampling ring was stored for transport to the analytical laboratory by labeling it, capping it with a plastic cap, and sealing it with duct tape. The analytical soil samples were placed in an ice chest containing ice until their delivery to the analytical laboratory. A geologist logged the soil in each sample and screened it for organic vapors using an organic vapor monitor (OVM). The soil that was encountered in each borehole is described on the soil boring and monitoring well construction logs provided in Appendices A and B.

Upon completion of each borehole, it was either abandoned in accordance with The Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 of the Washington Administrative Code, WAC 173-160) or it was completed as a well. Monitoring wells MW-1 through MW-4 were constructed with four-inch diameter, flush-threaded, 0.010-inch slotted, schedule 40, PVC well screen and flush-threaded, four-inch diameter, schedule 40, PVC blank riser pipe. Monitoring wells MW-5 through MW-7 and soil vapor test well SG-1 were constructed of the same well materials except they were constructed with two-inch diameter well casing. The well casing was lowered to the bottom of each borehole and 10/20 Colorado silica sand was placed to a level two to three feet above the slotted casing. A 3.5- to 5-foot interval of bentonite chips was placed above the sand pack, and the remainder of each borehole was grouted with concrete. The well heads were completed using flush-mounted, watertight, cast aluminum or iron well covers.

The monitoring well construction logs provided in Appendix B illustrate the well construction details for each monitoring well. Table 2 summarizes the well construction details for all monitoring wells.

#### 3.2 WELL DEVELOPMENT

The wells were developed by bailing or using a hand pump. Temperature, specific conductivity, and relative turbidity were monitored during development. Well development was discontinued when these parameters had stabilized. Typically, three to five well volumes of ground water were removed during well development. It was not possible to produce clear water in the wells because of the fine-grained nature of the surrounding formations.

#### 3.3 WELL ELEVATION SURVEY

Each ground-water monitoring well was surveyed to the nearest 0.01 foot to determine the relative vertical elevation of a reference point on the well casing. In addition, the elevation of the eleventh post on the north side of a small dock in the Duwamish was surveyed (Figure 3) so that the relative elevation of the water level in the Duwamish could be measured. Elevations were surveyed relative to the site bench mark, which is the yellow-painted obstruction post located west of the voltage transformer on the south side of the site (Figure 3). The site bench mark is assigned an arbitrary elevation of 100.00 feet. Surveying was performed by Dames & Moore personnel on January 15, 1991. Table 3 lists the well reference elevations.

#### 3.4 WATER LEVEL SURVEYS

Water levels were measured in the site wells on November 8, 1990, and January 15 and 25, 1991. Water level measurements were obtained within a one-half hour time span during each sampling event to minimize influences from tidal swings in the Duwamish Waterway. Table 3 summarizes the water level data.

#### 3.5 GROUND-WATER SAMPLING

Ground-water samples were collected from the wells on November 1 and December 18, 1990. Equipment that entered the wells was cleaned between each well. Cleaning consisted of washing the equipment with a water and Alconox solution, triple rinsing it with tap water, and then rinsing it with distilled water.

Before ground-water samples were collected, the wells were purged to remove stagnant well water. The wells were purged by bailing while monitoring the indicator parameters of pH, temperature, and specific conductivity. Purging was discontinued upon stabilization of these parameters. Typically, three well volumes of ground water were removed during purging.

Ground-water samples were collected using a clean Teflon bailer. Each sample was handled and bottled as required by EPA methodology and labeled with its sample number, monitoring well number, sample date and time. The samples were stored in an ice chest containing ice until their delivery to the analytical laboratory.

#### 3.6 GROUND-WATER QA/QC SAMPLES

For each sampling event, one duplicate and one rinsate sample were collected and analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX) by EPA Method 8020. The duplicate sample was collected by using water from the same bailer that collected the original sample. The rinsate sample was obtained by collecting distilled water that was poured through a decontaminated sample bailer. The rinsate and duplicate samples were bottled, labeled, stored, and delivered to the laboratory using the same procedures as for other BTEX samples.

#### 3.7 CHAIN-OF-CUSTODY

Evidence of sample location, shipment, laboratory receipt, and laboratory custody until disposal was documented for the analytical samples. Documentation was accomplished with a chain-of-custody form that recorded each sample and each individual responsible for sample collection, shipment, and receipt. The chain-of-custody form was signed by each individual who took possession of the samples. Copies of the chain-of-custody forms are provided in Appendices C and D.

#### 3.8 SAMPLE ANALYSES

Soil and ground-water samples were analyzed by Alden Analytical Laboratories located in Seattle, Washington. Soil samples were analyzed in the preliminary assessment for TPH using modified EPA Method 8015 and BTEX using EPA Method 8020. In the followup assessment, selected soil samples were analyzed for TPH, polycyclic aromatic hydrocarbons (PAH) using EPA Method 8270, and volatile organic compounds (VOC) using EPA Method 8240. Soil samples were selected for TPH analysis to help evaluate the vertical extent of petroleum constituents. Soil samples were selected for PAH and VOC analyses based on the sample depth which contained the highest TPH values in nearby boreholes during the preliminary assessment.

In the preliminary assessment, ground-water samples collected from monitoring wells MW-1 through MW-4 were analyzed for BTEX using EPA Method 8020 and TPH using modified EPA Method 8015. In the followup assessment, ground-water samples were collected from monitoring wells MW-3 through MW-7 and analyzed for BTEX.

#### 4.0 RESULTS OF FIELD ACTIVITIES

This section describes the results of the field program. Section 4.1 describes the subsurface soils in the areas where monitoring wells were installed or soil borings were drilled. Section 4.2 describes the occurrence of ground water at the site. Section 4.3 reports the analytical results obtained from soil samples, and Section 4.4 reports the analytical results obtained from ground-water samples. Section 4.5 provides the results of ground-water QA/QC sampling.

#### 4.1 SOIL LITHOLOGY

The soil in the area of this assessment generally consists of an upper unit, five to 11 feet thick, of poorly sorted sand, which is generally loose to medium dense, black, fine or medium to coarse, and often contains gravel, wood chips, and pieces of concrete and brick. Underlying the upper sand is a silty or clayey fine sand unit that ranges from 1.5 to five feet in thickness, which is generally, but not always, underlain in turn by a silty clay or clayey silt unit up to 12 feet thick. In borehole SB-5, a poorly sorted fine sand underlies the clay unit. In the northern portion of the assessment area, near monitoring wells MW-5 and MW-7, the soil consists entirely of clayey or silty sand.

Based on information obtained during the historical research (Section 2.0), it appears probable that most, if not all, of the soil encountered during the field program is artificial fill placed at the site when the old turning basin was filled. Individual soil strata appeared to be discontinuous, and characteristics were not identified that could be used to distinguish between artificial fill and natural sediments.

#### 4.2 GROUND-WATER OCCURRENCE

Ground water occurs at depths between approximately nine and twelve feet. Table 3 provides the measured depth to water and calculated water elevations for three monitoring events. The data from two of the monitoring events were used to generate ground-water contour maps, as shown on Figures 4 and 5.

These ground-water contour maps are highly interpretive and are based on the available data and an understanding of ground-water flow. These maps show that ground water at the site appears to be strongly influenced by tidal swings in the Duwamish Waterway. Ground water appears to flow both away from and toward the Duwamish, which is consistent with the expected flow of ground water that is tidally influenced.

Based on the available data, it is difficult to calculate reliable estimates of ground-water gradients, flow rates, or discharge to the Duwamish Waterway. It is also not clear at this time if ground water occurs under confined or unconfined conditions. Confined conditions are suggested by the presence of tidal swings in the ground water at a significant distance inland from the Duwamish Waterway. Additional work would be required to clarify these issues.

#### 4.3 SOIL GEOCHEMISTRY

Appendix C contains the analytical laboratory reports for soil samples collected during this assessment. The results of the soil analyses are summarized on Table 4 and discussed in subsections 4.3.1 through 4.3.4. In the following discussion, analytical results are compared with the proposed cleanup criteria contained in *The Model Toxics Control Act Cleanup Regulation* effective February 28, 1991 (MTCA). The relevant MTCA criteria are included on Table 4 and analyses that exceed the MTCA criteria are shown in bold.

#### 4.3.1 Total Petroleum Hydrocarbons (TPH)

TPH values in soil samples collected during this assessment ranged between 12 and 3,600 mg/kg (Table 4). The laboratory chromatographs, provided in Appendix E, indicate that the product detected in the soil samples appears to be primarily oil with only a relatively small component of diesel in samples collected near the USTs. Because gasoline was not identified in the samples, diesel or oil MTCA cleanup criteria are appropriate for the site soil (200 mg/kg).

In the first phase of this project, soil samples were only collected from above the water table or just below the water table. These results indicated that some of the highest TPH values were present in samples collected from below the water table. In the followup assessment, soil samples were collected from boreholes SB-4 and SB-5 to depths of 33 feet. In these boreholes, TPH values exceeded the MTCA criteria for diesel and/or oil to depths of approximately 30 feet.

The lateral extent of soil containing TPH in concentrations above MTCA criteria has not been fully defined because only a limited number of soil samples have been collected from below the water table.

#### 4.3.2 Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX)

The BTEX results from soil samples are summarized on Table 4. As can be seen by a review of this table, BTEX compounds were detected only in soil samples collected near the USTs and only in concentrations that are well below their MTCA criteria. The highest benzene (97 ug/kg), toluene (13 ug/kg), and xylene (18 ug/kg) concentrations were detected in the soil vapor extraction test well SG-1 at a depth of approximately 3.0 feet.

#### 4.3.3 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs were not detected in the sample collected from SB-4 and only low levels of fluoranthene (56 ug/kg), phenanthrene (67 ug/kg), and pyrene (70 ug/kg) were detected in the sample collected from SB-5. The MTCA industrial criteria for PAHs is 20 mg/kg (20,000 ug/kg) for the sum of carcinogenic PAHs. Fluoranthene is the only carcinogenic PAH that was detected in these samples, and its concentration (56 ug/kg) does not exceed the MTCA criteria for carcinogenic PAHs.

#### 4.3.4 Volatile Organic Compounds (VOCs)

Acetone and methylene chloride were detected in the two samples analyzed for VOC. Acetone was detected in concentrations of 220 and 94 ug/kg, and methylene chloride was detected in concentrations of 110 and 54 ug/kg. The MTCA cleanup criteria for methylene chloride is 500 ug/kg, but is not established for acetone.

#### 4.4 GROUND-WATER GEOCHEMISTRY

Appendix D contains the analytical laboratory reports for ground-water samples collected during this assessment. The results of the ground-water analyses and the relevant MTCA criteria are summarized on Table 5 and discussed in the following subsections.

#### 4.4.1 Total Petroleum Hydrocarbons (TPH)

As can be seen from review of Table 5, the TPH values in ground water during the preliminary assessment ranged between 0.27 and 0.59 mg/L. These values are well below the MTCA ground-water criteria for TPH of 1.0 mg/L. The sampling performed during the followup assessment did not include TPH analyses, based on the results from the preliminary assessment. This data suggests that site ground water has the potential to discharge only low levels of TPH, if any, to the Duwamish Waterway.

#### 4.4.2 Benzene, Toluene, Ethylbenzene, Xylenes (BTEX)

The BTEX sampling results from ground-water samples are tabulated on Table 5. During the preliminary sampling, BTEX constituents were detected only in samples collected from monitoring well MW-4. In that sample, only the benzene concentration (4,200 ug/L) exceeded MTCA criteria (5.0 ug/L). A duplicate sample collected from this well (see Section 4.5 of this report) contained a similar benzene concentration (3,600 ug/L).

In the followup sampling performed in December 1990, monitoring well MW-4 contained similar benzene concentrations and higher detection levels. Monitoring wells MW-5, MW-6, and

MW-7, which were installed to evaluate benzene concentrations in a down-gradient direction, did not contain detectable concentrations of BTEX. The sample from monitoring well MW-3, however, contained BTEX compounds, including 420 ug/L benzene.

Samples collected from monitoring wells MW-2, MW-5, MW-6, and MW-7 did not contain detectable BTEX. These wells are located between the detected occurrence of benzene in monitoring well MW-4 and the Duwamish Waterway. This data suggests that site ground water does not discharge BTEX constituents into the Duwamish Waterway.

#### 4.5 GROUND-WATER QA/QC ANALYSES

The laboratory reports for the ground-water QA/QC samples are provided in Appendix D and the results are summarized on Table 6. Analyses of the duplicate samples indicate that the benzene results were reproducible to within 12 percent and the other BTEX compounds within 12 to 35 percent.

The results from the rinsate sampling show that BTEX concentrations were below detection levels for both the first and second rounds of sampling, except for ethylbenzene during the second round of sampling. The low level of ethylbenzene (1.4 ug/L) that was detected in the rinsate sample may represent laboratory, field collection, or field handling errors. This low concentration of ethylbenzene is not considered significant to the results of the ground-water sampling.

#### 5.0 SUMMARY, DISCUSSION, AND RECOMMENDATIONS

This section provides a discussion concerning the significance of the findings from the soil and ground-water assessment. Section 5.1 discusses the results of the soil assessment and Section 5.2 discusses the results of the ground-water assessment. Section 5.3 discusses the regulatory considerations that apply to this site, and Section 5.4 provides recommendations for future activities.

#### 5.1 SOIL CONDITIONS

The laboratory chromatographs (Appendix E) indicate that the principal hydrocarbon in the subsurface soil is oil, although diesel is apparently present to a lesser extent. Only 95 mg/kg TPH was identified in the soil sample collected from immediately below the UST excavation (Dames & Moore, 1991). BTEX, VOCs, and PAHs have not been detected in soil samples in concentrations that exceed MTCA criteria.

Elevated TPH concentrations occur in soil below the water table, even though TPH concentrations are very low in the ground water. This suggests that the oil may be relatively old and weathered, and consist primarily of residual petroleum constituents that are relatively immobile in the subsurface.

The extent of residual oil occurrence in the subsurface has not been determined. It appears, based on the results from boreholes SB-4 and SB-5 that TPH occurs in concentrations above MTCA criteria to depths of approximately 30 feet. The lateral extent of TPH is not known because sampling below the water table has been performed in only two boreholes. Based on the existing information, it appears that TPH concentrations exceed the MTCA criteria in a minimum area of approximately 150 by 150 feet. If it is assumed that TPH extends to a uniform depth of approximately 30 feet, and that only 20 of the 30 vertical feet have TPH levels that exceed MTCA criteria, the minimum volume of soil that exceeds MTCA is approximately 16,700 cubic yards (cy).

There are three known potential sources for the oil identified at the site: 1) waste oil USTs that were used by the bus company between approximately 1978 and 1982, 2) oil disposed by Northwest Cooperage during World War II, and 3) imported material used to backfill the old turning basin. The principal interpretations of the soil data that can be made concerning potential source(s) of the oil are as follows:

• In areas of borehole SB-4 and SB-5, the TPH concentrations in soil samples collected from depth tend to be higher than those collected from near the current ground surface (Table 7). This information is compatible with any of the known potential oil sources.

If Laidlaw disposed of waste oil in USTs, then high TPH concentrations would be expected at depths lower than the bottom of the USTs. If Northwest Cooperage disposed of oil in the turning basin, high TPH concentrations may be expected in the sediment that underlay the former turning basin during World War II. If the material used to backfill the old turning basin contained varying levels of oil, then the present distribution of TPH would be expected to be heterogeneous.

- TPH is present over a wide area of the site. This information is more compatible with the potential Northwest Cooperage source than a point source associated with Laidlaw's waste oil USTs. If oil was disposed in USTs, high TPH values would be expected in a relatively limited area near the USTs due to the relatively low mobility of oil in the subsurface environment. If oil was disposed in the old Duwamish turning basin, it could be expected that oil would be present in a relatively larger area because of the possibility for its unconstrained flow within the tidally-influenced Duwamish River. If the oil was associated with the backfill, TPH concentrations could be expected throughout the site or in discrete areas.
- The oil appears to be old as indicated by the lack of odors during drilling and the lack
  of significant TPH concentrations in the ground water. This information appears to be
  more compatible with a source that is approximately 50 years old (Northwest Cooperage
  and site backfill) than a source that is 15 years old (Laidlaw).

Because the TPH concentrations in site soil exceed MTCA criteria, it may be necessary to contain or remove the TPH. However, the results from this assessment suggest that the potential for the presence of TPH to adversely impact human health or the environment is low. The principal interpretations of the soil data that can be made concerning the need for remedial action are as follows:

- The presence of oil in the subsurface does not appear to be associated with significant levels of PAHs or VOCs. PAH and VOC compounds are likely to pose more environmental concern than oil.
- The presence of relatively high TPH concentrations in the soil (up to 3,600 mg/kg) does
  not appear to be resulting in high levels of TPH in the ground water (less than 0.59
  mg/L). This suggests that the oil is currently a residual material that appears to be
  immobile in the subsurface environment and significant migration of oil is not likely to
  occur.

Although a detailed feasibility study concerning remedial alternatives has not been performed, four remedial approaches for remediation of TPH in soil have been identified and qualitatively evaluated for their effectiveness. The four candidate alternatives include: soil vapor

extraction, fixation, containment, and disposal. The effectiveness of each alternative is briefly discussed below.

- Soil vapor extraction Site conditions do not appear to be favorable for effective soil vapor extraction technologies because the TPH is primarily oil (low volatility) and the soil formation is highly silty (low permeability).
- Soil Fixation Although fixation processes are appropriate technologies for reducing
  contaminant migration, they do not typically remove or reduce the concentration of
  contaminants. Because the soil TPH does not appear to currently be contributing
  significant concentrations of TPH to the ground water, it is unlikely that implementation
  of fixation processes will significantly reduce the already apparently low potential for
  TPH migration.
- Containment Like fixation processes, containment technologies help reduce the likelihood of contaminant migration, but they do not remove contaminants. Containment is not likely to significantly reduce the potential for TPH migration at the site because the potential for migration is already relatively low.
- Excavation and Disposal Excavation and disposal is an alternative that is feasible and will remove TPH from the site. However, the cost to dispose the known volume of soil is estimated to be over \$2 million alone, assuming 1.3 ton/cy of soil, \$100/ton disposal fee, and 16,700 cy of soil to be disposed. Other costs associated with this option include: excavation, replacement, and recompaction of the soil; transportation; repavement; engineering; confirmation sampling; and costs associated with interruption to site activities. Although the excavation and disposal option appears to be an effective and implementable technology for reducing TPH concentrations at the site, the cost to implement the option appears excessive relative to the apparent reduction in risk that could be attained.

In conclusion, it appears that the effectiveness of alternative remedial measures is likely to be either low, due to site conditions, or costly, relative to the apparent reduction in risk to human health and the environment that could be attained. Although further work would be required to fully evaluate remedial alternatives, it does not seem appropriate at this time to do so based on the low potential for contaminant migration that has been identified.

#### 5.2 GROUND-WATER CONDITIONS

The results of the ground-water sampling suggest that the principal concerns in ground water are the BTEX compounds. TPH concentrations from samples collected during the

preliminary assessment were less than 0.59 mg/L which is well below MTCA criteria. In the first round of sampling, only benzene in one well (monitoring well MW-4) exceeded MTCA criteria. In the second round of sampling, benzene, as well as total xylenes, exceeded MTCA in two wells (monitoring wells MW-3 and MW-4). These results may be explained as the result of either: 1) disturbances in equilibrium conditions resulting from drilling and well installation activities, or 2) normal fluctuations in BTEX concentrations resulting from tidal influences or other site-specific causes. In either case, additional sampling would be required to provide more reliable estimates concerning the extent of BTEX in ground water.

The most likely source of BTEX in ground water samples collected from monitoring well MW-4 is tank T-3 and/or its associated piping. The most likely source of BTEX in the ground water samples collected from monitoring well MW-3 is tank T-2.

Based on the available data, it appears that the extent of BTEX in ground water is known in three direction by samples collected from monitoring wells MW-1, MW-2, MW-6, and MW-7 (Figure 6). The extent of BTEX in the upgradient direction is difficult to determine because wells cannot be located within the refrigeration shop nor in the area north of the refrigeration shop because concrete is present at depth (described in Section 3.1). However, because BTEX is not present in monitoring well MW-1, which is located in the apparent upgradient direction from tank T-2, the extent of benzene in the upgradient direction is likely to be limited. Benzene concentrations exceed MTCA criteria within a localized area that appears to be no larger than approximately 100 feet by 50 feet (Figure 6).

The data suggests that BTEX is not being discharged to the Duwamish Waterway. The monitoring wells located closest to the Duwamish Waterway (monitoring wells MW-2, MW-5, MW-6, and MW-7) do not contain detectable concentrations of BTEX. The lack of benzene in these wells suggests either: 1) that ground-water flow and migration rates are low, 2) natural biodegradation processes are effectively removing petroleum constituents from the ground water, or 3) a combination of these two alternatives. Although it is difficult to estimate accurate ground-water flow and contaminant migration rates based on the available data (see Section 4.2), it is likely that BTEX are being naturally degraded faster than they are being transported toward the Duwamish Waterway.

Because it appears likely that natural biodegradation processes are effective in naturally removing BTEX from the ground water before it is discharged to the Duwamish Waterway, ground-water remediation does not seem necessary at this time. Additional sampling and analysis would be required to further evaluate these possibilities.

#### 5.3 REGULATORY CONSIDERATIONS

MTCA regulation (WAC 173-340-300) requires owner/operators to report releases of a hazardous substance to the Washington Department of Ecology (WDOE). The report is to include such information as the identification and location of the substance, circumstances concerning the release and its discovery, the results of site investigation activities, and remedial actions that are planned, completed, or underway.

WDOE will have 90 days to review the report, visit the site (if appropriate), and provide AML with their decision. Their decision will require either: 1) further investigation, 2) immediate remedial actions, or 3) no further action.

#### 5.4 RECOMMENDATIONS

Based on the findings from the site assessment and the requirements of MTCA, the following recommendations are provided for future site actions:

#### · Reporting

This report should be provided to WDOE to comply with the reporting requirement of MTCA.

#### · Quarterly Ground-Water Sampling

Ground-water samples should be collected from the site on a quarterly basis for one year. Samples should be collected from all site monitoring wells and analyzed for TPH by modified EPA Method 8015 and BTEX by EPA Method 8020. Sample blanks and rinsate samples should be collected and analyzed for BTEX with each sampling event. All site activities should be performed in accordance with the field procedures described in this report.

#### · Ground-Water Monitoring

Ground-water elevations should be collected from all site wells on a quarterly basis in conjunction with the quarterly ground-water sampling program. Ground-water contour maps should be generated for each monitoring period.

Water elevations should be monitored for a 24-hour period in selected wells to evaluate tidal influences on site ground-water flow. Permeability tests should be performed in selected wells to determine hydraulic conductivities. This information should be used to estimate ground-water flow directions and rates, evaluate confining conditions, and estimate petroleum transport rates.

#### · Monitoring Plan

After one year of quarterly ground-water sampling and monitoring, the data should be compiled and reviewed. The data should be used to evaluate risks to the environment and human health that are associated with existing site conditions. Based on the results of the data review and risk assessment, the need for remedial actions should be evaluated.

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# TABLE 1 SUMMARY OF HISTORICAL DATA 7100 Second Avenue Alaska Marine Lines

#### 1884 - Sanborn

Site vicinity is not included on maps.

#### 1920 - Kroll

The site appears to be under a portion of the Duwamish River. The old First Avenue Bridge is present and a Boeing production plant is located approximately 750 feet west of the site.

#### 1926 - Metzker

No significant changes observed.

#### 1929 - Sanborn

The site is not on the maps. Boeing is present east of the site area, across West Michigan Street and First Avenue SW.

#### 1936 - Metzker

The general area appears to be more developed and more streets are present, but there are no significant changes to the site area.

#### 1940 - Kroll

The property is obviously located within a turning basin on the Duwamish River.

#### 1944 - Sanborn

A gas and oil outlet (service station?) are located across West Michigan Street and First Avenue SW (to the west). Boeing has substantially developed the block encompassed by Peninsula Place, Second Avenue SW, and West Michigan Street.

#### 1950 - Kroll

A service station is located near the western edge of the site, at Second Avenue Southwest and First Avenue South. There are several unspecified, small buildings near the site.

#### 1958 - Kroll

The First Avenue South Bridge appears to have been constructed in its present location.

#### 1966 - Kroll

The former turning basin has been filled. Northwest Cooperage Company is shown adjacent to the south side of the site.

AML/R3-T1.WP

## TABLE 1 (CONT'D) SUMMARY OF HISTORICAL DATA 7100 SECOND AVENUE ALASKA MARINE LINES

1971 - Kroll

No significant changes from the 1966 Kroll map.

1971 - Aerial Photograph

The site has at least one large building at its southern edge and a dock on the Duwamish Waterway. Several large vehicles or stacked materials are located on the site.

1972 - Aerial Photograph

There are clearly two buildings at the southern edge of the site. The ground on the site appears to be extensively reworked.

1976 - Aerial Photograph

No significant changes at the site since the 1972 aerial photograph.

1977 - LTI, Letter from LTI to ARA

Mentions the presence of lube oil tanks at the site.

1978 - LTI, Approved Permit for Shoreline Management Development.

Important information contained in this permit includes:

- Plans to install: 1) about four acres asphalt paving, 2) a storm drainage system with catch basins and manholes, 3) asphalt extruded curb along the northeasterly bank of the Duwamish River, and 4) a storm drain outfall (18-inch pipe).
- The site was being used for barge loading on the north end of the property and school bus servicing and maintenance in the southern end. As part of the school bus operation, there were two garages and gas pumps on site. About 200 buses were being serviced on a regular basis for both major and minor repairs within the buildings. Every 3,000 miles or 30 days the buses were lubed with oil and filter changes.
- The southern portion of the site was occupied by a ready-mix concrete plant until about one year before the permit was applied for.
- The site was unpaved at the time of the permit application.

# TABLE 1 (CONT'D) SUMMARY OF HISTORICAL DATA 7100 SECOND AVENUE ALASKA MARINE LINES

#### 1978 - LTI, Summary of Charges to Associated,

This document contains a reference to the installation of an underground drainage and oil separator system at the site.

#### 1981 - Polk Directory

Site address listed as Associated School Bus Service.

#### 1983 - Polk Directory

Site address listed as ARA Transportation Freight Lines.

#### 1985 - Aerial Photograph

It appears that the site has been paved. Another large building has been added near the southern end of the site, just north of the two pre-existing buildings. At least two other small buildings, freight vehicles, or stacked materials are on the site, and two barges are moored in the Duwamish at the northern edge of the site.

#### 1985 - Polk Directory

Site address is listed as Alaska Marine Lines; 7150 Second Avenue is listed as Jore Corporation Trucking.

#### 1986 - Polk Directory

Same as 1985 Polk Directory listing.

#### 1987 - Kroll

The Portland-Puget Sound addition is located southwest of the site adjacent to Northwest Cooperage. Lots on other side of First Avenue South are shown as "vacated". Alaska Marine Lines is not shown.

#### 1987/88 - Polk Directory

7150 Second Avenue is listed as vacant.

#### 1988 - Aerial Photograph

The easternmost building at the southern edge of the site has been removed. A second dock has been added southeast of the first dock.

#### 1989/90 - Polk Directory

Same as 1987/88 Polk Directory listing.

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TABLE 2
SUMMARY OF WELL CONSTRUCTION DETAILS
7100 Second Avenue
Alaska Marine Lines

WELL NO.	INSTALL DATE	BOREHOLE DIAMETER (Inches)	WELL CASING DIAMETER (inches)	CASING TOTAL DEPTH (feet)	TOP OF SCREEN (feet)	TOP OF SAND PACK (feet)	TOP OF SEAL (feet)	SLOT SIZE (inches)	MONUMENT TYPE
MW-1	10/25/90	12	4	20	10	8	4.5	0.01	Flush-Cast Aluminum
MW-2	10/25/90	12	4	20	10	8	3	0.01	Flush-Cast Aluminum
MW-3	10/25/90	12	4	20	10	8	3	0.01	Flush-Cast Aluminum
MW-4	10/26/90	12	4	20	10	8	3	0.01	Flush-Cast Aluminum
MW-5	12/06/90	6	2	3.8	1.8	6.5	2	0.01	Flush-Cast Iron
MW-6	12/07/90	6	2	19	9	6	2	0.01	Flush-Cast Iron
MW-7	12/07/90	6	2	19	9	6	2	0.01	Flush-Cast Iron
SG-1	10/26/90	6	2	11.5	5	3	1.5	0.01	Flush-Cast Iron

AML:\R3-T2.XLS

TABLE 3
SUMMARY OF WATER LEVEL DATA
7100 Second Avenue
Alaska Marine Lines

		NOVEMBER 1, 1991		JANUAR'	Y 15, 1991	JANUAR	Y 25, 1991
		DEPTH	WATER	DEPTH	WATER	DEPTH	WATER
WELL	REFERENCE	TO	LEVEL	TO	LEVEL	то	LEVEL
NO	ELEVATION	WATER	ELEV.	WATER	ELEV.	WATER	ELEV.
MW-1	99.84	11.97	87.87	11.14	88.70	11.53	88.31
MW-2	99.52	11.34	88.18	10.44	89.08	11.12	88.40
мw-з	99.71	11.82	87.89	10.96	88.75	11.28	88.43
MW-4	99.42	10.97	88.45	10.11	89.31	10.20	89.22
MW-5	98.32		•	8.75	89.57	9.21	89.11
MW-6	98.43	-	•	8.77	89.66	9.38	89.05
MW-7	99.48		•	8.98	90.50	9.00	90.48
PIER	101.37	-	-	13.43	87.94	12.12	89.25
L,				<u> </u>		L	

AML/R3-T3.XLS

## TABLE 4 SUMMARY OF SOIL ANALYTICAL DATA 7100 Second Avenue Alaska Marine Lines

				FUEI	_ CONSTITUI				YCYCLIC AROM	<del>-</del>		ORGANIC DUNDS
BORE-						ETHYL-		*FLUOR-	PHEN-			METHYLENE
HOLE	SAMPLE	SAMPLE	TPH	BENZENE	TOLUENE	BENZENE	XYLENES	ANTHENE	ANTHRENE	PYRENE	ACETONE	CHLORIDE
NO.	DEPTH	DATE	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
SB-1	3.0-3.5	10/25/90	12	<5.0	<5.0	<5.0	<5.0		***		-	
SB-1	11.0-11.5	10/25/90	73	<5.0	<5.0	<5.0	<5.0					
SB-2	3.0-3.5	10/25/90	57	<5.0	<5.0	<5.0	<5.0	**	***	***		**
SB-2	8.0-8.5	10/25/90	350	<5.0	<5.0	<5.0	<5.0			-		
SB-3	3.0-3.5	10/25/90	99	<5.0	<5.0	<5.0	<5.0	-		**	-	**
SB-3	11.0-11.5	10/25/90	31	<5.0	<5,0	<5.0	<5.0				-	
SB-4	8.0-8.5	12/13/90	130	-		**		<40	<40	<40	220	110
SB-4	13.0-13.5	12/13/90	207	-		all the		-				
SB-4	18.0-18.5	12/13/90	460						-			
SB-4	23.0-23.5	12/13/90	240	-			-			_	_	
SB-4	28.0-28.5	12/13/90	450	} -	-			-			-	***
SB-4	33.0-33.5	12/13/90	55					<u></u>				
SB-5	13.0-13.5	12/13/90	210		***			56	67	70	94	54
SB-5	18.0-18.5	12/13/90	3600								-	
SB-5	23.0-23.5	12/13/90	110								-	
SB-5	28.0-28.5	12/13/90	340						and .		ļ	
SB-5	33.0-33.5	12/13/90	59								l –	
SG-1	3.0-3.5	10/25/90	2800	97	13	<5.0	18					
SG-1	11.0-11.5	10/25/90	18	10	<5.0	<5.0	<5.0		***			**
MW-1	3.0-3.5	10/26/90	720	<2.0	<2.0	<2.0	<2.0	**				
MW-1	8.0-8.5	10/26/90	480	<2.0	<2.0	<2.0	<2.0				-	
MW-1	13.0-13.5	10/26/90	820	<2.0	<2.0	<2.0	<2.0		-		_	
MW-2	3.0-3.5	10/26/90	25	<2.0	<2.0	<2.0	<2.0			**	-	
MW-2	13.0-13.5	10/26/90	110	50	<2.0	<2.0	<2.0				]	
MW-2	18.0-18.5	10/26/90	350	<2.0	<2.0	<2.0	<2.0			-	-	
MW-3	3.0-3.5	10/26/90	550	15	2.3	<2.0	<2.0		A+	***	_	
MW-3	13.0-13.5	10/26/90	380	28	<2.0	<2.0	<2.0			<b></b>	_	
MW-3	18.0-18.5	10/26/90	540	<2.0	<2.0	<2.0	<2.0			***	-	
MW-4	3.0-3.5	10/25/90	360	<5.0	<5.0	<5.0	<5.0		***	_		**
	MTCA		200	500	40,000	20,000	20,000	**	**	**	NE	500

AML:\R3-T4.XLS

MTCA = Model Toxics Control Act Cleanup Regulation, effective February 28, 1991.

Only those compounds that were detected in one or more samples are reported.

<sup>- =</sup> Not analyzed

<sup>\* =</sup> Carcinogenic PAH compound.

<sup>\*\* =</sup> MTCA criteria is 20,000 ug/kg for the sum of all carcinogenic PAHs.

## TABLE 5 SUMMARY OF GROUND-WATER ANALYTICAL DATA 7100 Second Avenue Alaska Marine Lines

		WELL NO:	MW-1	MW-2	M'	W-3	M\	N-4	MW-5	MW-6	MW-7
	SA	MPLE DATE:	11/1/90	11/1/90	11/1/90	12/18/90	11/1/90	12/18/90	12/18/90	12/18/90	12/18/90
ANALYSIS	UNITS	MTCA [1]									
трн	mg/L	1	0.59	0.56	0.33		0.27				**
BENZENE	ug/L	5	<1.0	<1.0	<1.0	420	4200	3600	<5.0	<5.0	<5.0
TOLUENE	ug/L	40	<1.0	<1.0	<1.0	3.5	8.3	<50	<5.0	<5.0	<5.0
ETHYLBENZENE	ug/L	30	<1.0	<1.0	1.1	13	2.1	<50	<5.0	<5.0	<5.0
XYLENES	ug/L	20	<1.0	<1.0	5.3	48.4	4.2	63	<5.0	<5.0	<5.0

AML/R3-T5.XLS

MTCA = The Model Toxics Control Act Cleanup Regulation, effective February 28, 1991.

- -- = Sample not analyzed.
- < = This parameter was not detected at a concentration above the detection level indicated in the table.

# TABLE 6 SUMMARY OF GROUND-WATER QA/QC ANALYTICAL DATA 7100 Second Avenue Alaska Marine Lines

DUPLICATE	SAMPLING	WELL	ANALYSIS	SAMPLE	DUPLICATE
WELL	DATE	NO	(ug/L)	VALUES	VALUES
SAMPLES					
	11-1-90	MW-4	Benzene	4200	3700
			Toluene	8.3	6.9
			Ethylbenzene	2.1	1.4
			Xylenes	4.2	5.9
	12-18-90	MW-4	Benzene	4100	3600
			Toluene	<50	<50
			Ethylbenzene	<50	<50
			Xylenes	64	63

RINSATE SAMPLES	SAMPLING DATE	WELL NO	ANALYSIS (ug/L)	SAMPLE VALUES	DUPLICATE VALUES
	11-1-90	N/A	Benzene	<1.0	N/A
			Toluene	<1.0	N/A
			Ethylbenzene	<1.0	N/A
			Xylenes	<1.0	N/A
	12-18-90	N/A	Benzene	<1.0	N/A
			Toluene	<1.0	N/A
			Ethylbenzene	1.4	N/A
			Xylenes	<1.0	N/A

AMLAR3-T6.XLS

N/A - Not applicable.

## TABLE 7 TPH CONCENTRATIONS IN SOIL versus DEPTH 7100 Second Avenue Alaska Marine Lines

BOREHOLE NO:	SB-1	SB-2	SB-3	SB-4	SB-5	SG-1	MW-1	MW-2	MW-3	MW-4
SAMPLE DATE:	10/26/90	10/26/90	10/26/90	12/13/90	12/13/90	10/26/90	10/25/90	10/25/90	10/25/90	10/26/90
SAMPLE DEPTH: 3.0-3.5	12	57	99	*	*	2800	720	25	550	360
8.0-8.5	*	350	•	130	*	*	480	*	*	*
11.0-11.5	73	•	31	•	•	18	*	•	•	•
13.0-13.5				207	210	•	820	110	380	*
18.0-18.5				460	3600	*	•	350	540	•
23.0-23.5				240	110					
28.0-28.5				450	340					
33.0-33.5				55	59					

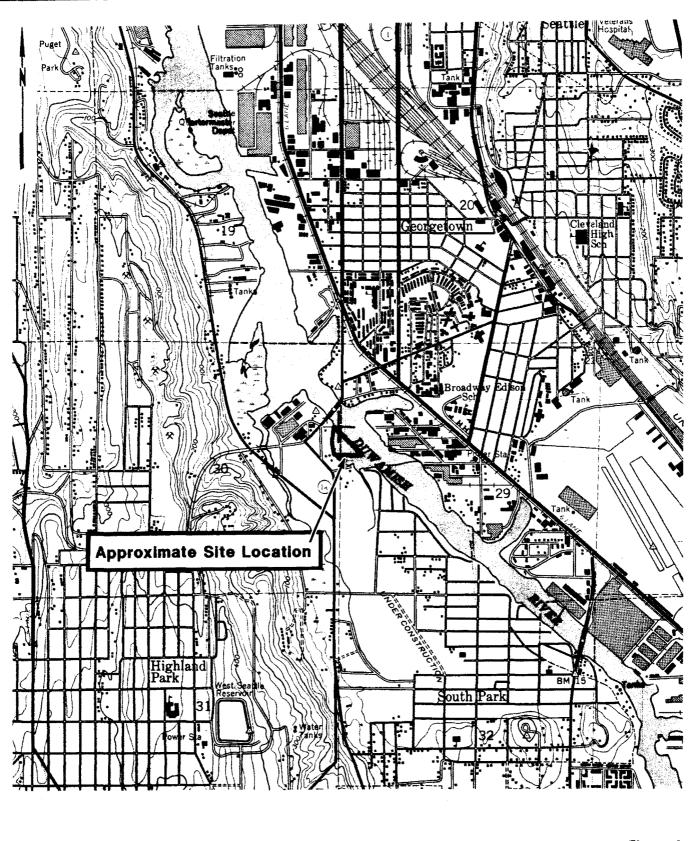
AML:AR3-T7.XLS

<sup>\* =</sup> Not analyzed.

Dames & Moore

Joh No. 21048-001-005

Quadrangle, 1949, Photorevised 1968 and 1973.



0 2000 4000 Scale in Feet

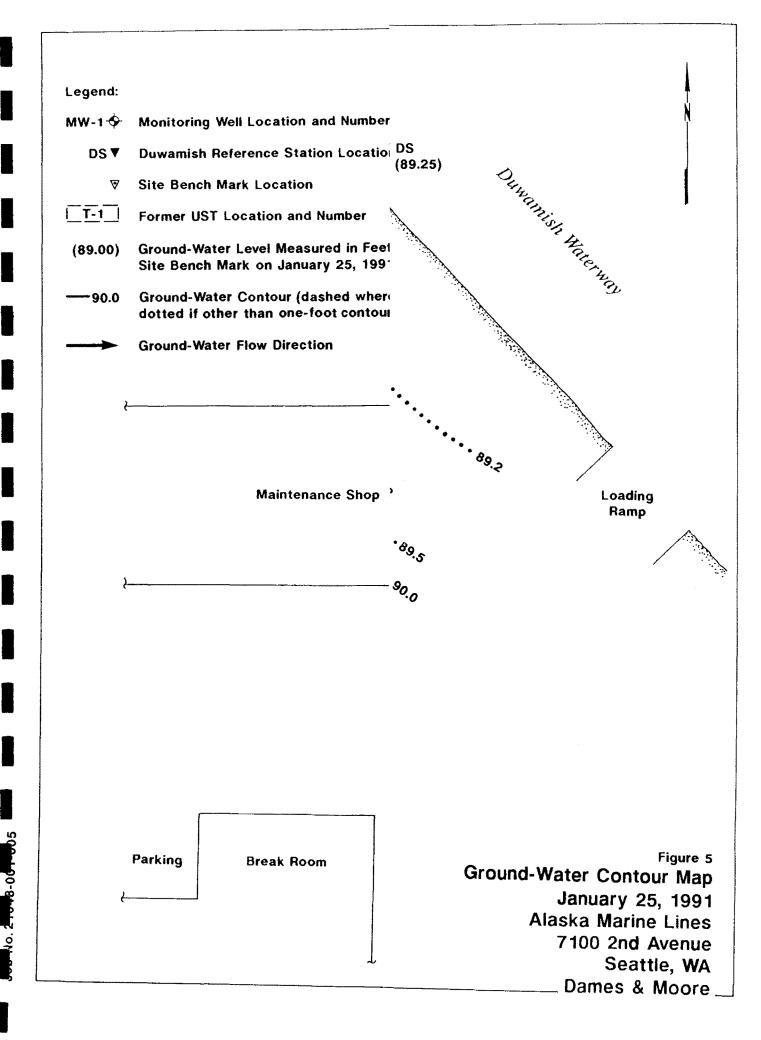
Source: USGS Topographic Map, 7.5 Minute Quadrangle, Seattle South, 1949.

Figure 2
1949 Site Location Map
Alaska Marine Lines
7100 2nd Avenue
Seattle, WA
Dames & Moore

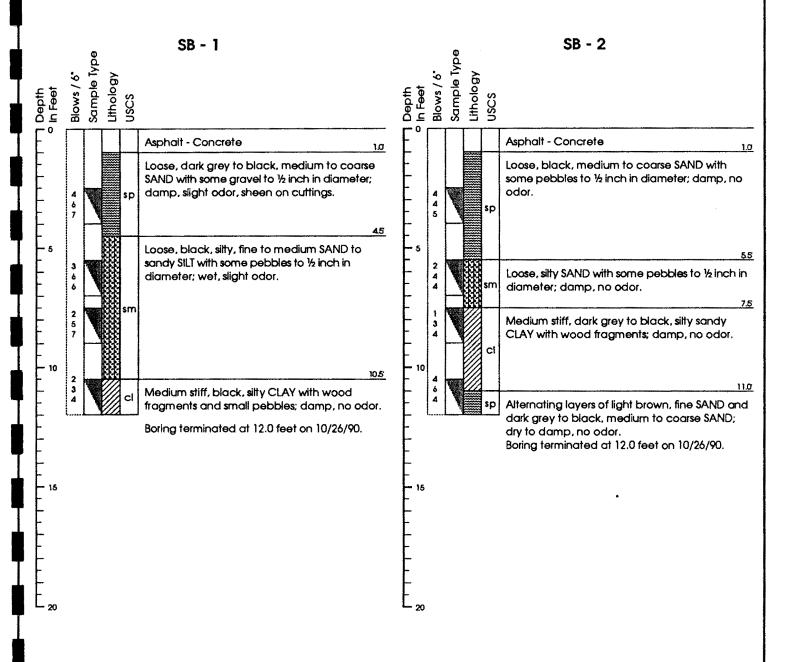
1				
1				
1				
1				
1				
1				
1				
1				

Legend:  MW-1 ❖  DS ▼  ▼  ————————————————————————————————	Monitoring Well Location and Number Duwamish Reference Station Location Site Bench Mark Location Former UST Location and Number Ground-Water Elevation Measured in Site Bench Mark on January 15, 199* Ground-Water Contour (dashed where dotted if other than one-foot contour Ground-Water Flow Direction	DS (87.94)  Dunanish Harerun
,	Maintenance Shop	Loading
÷	Parking Break Room	Figure 4 Ground-Water Contour Map January 15, 1991 Alaska Marine Lines 7100 2nd Avenue Seattle, WA Dames & Moore

JOB No. 21048-001-005



Job No. 21048-001-005



#### Notes:

Client Name: Alaska Marine Lines

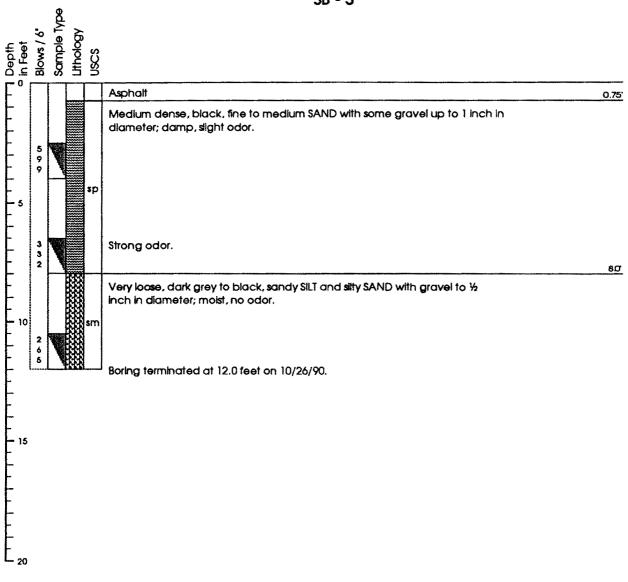
Project Name: 7100 2 No Ave.

Logged By: MAC

Drilling Co.: GeoBoring & Development, Inc.

Drilling Method: Hollow-Stem Auger

**SB - 3** 

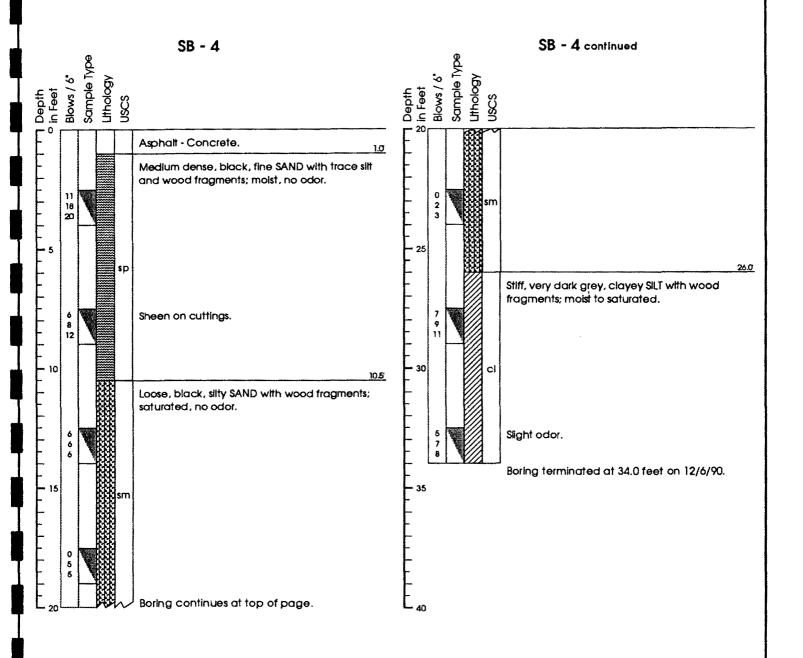


#### Notes:

Client Name: Alaska Marine Lines Project Name: 7100 2<sub>ND</sub>Ave.

Drilling Co.: GeoBoring & Development, Inc. Drilling Method: Hollow-Stem Auger

Logged By: MAC



#### Notes:

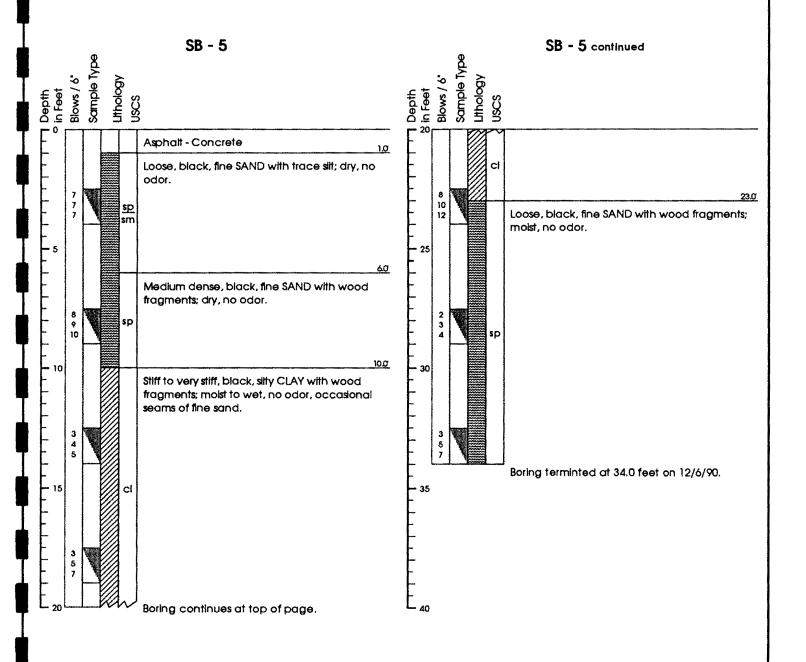
Client Name: Alaska Marine Lines

Project Name: 7100 2 ND Ave.

Logged By: JKM

Drilling Co.: GeoBoring & Development, Inc.

Drilling Method: Hollow-Stem Auger



#### Notes:

Client Name: Alaska Marine Lines

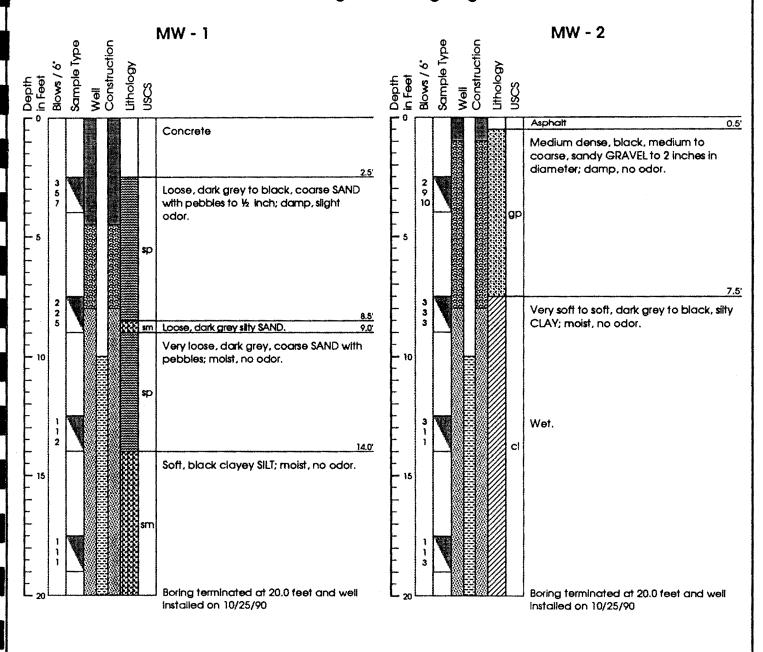
Drilling Co.: GeoBoring & Development, Inc.

Project Name: 7100 2 No Ave.

Logged By: IMW

Drilling Method: Hollow-Stem Auger

#### **Monitoring Well Construction and Geological Boring Log**



#### Notes:

Client Name: Alaska Marine Lines Project Name: 7100 2ND Ave.

Logged By:

Drilling Co.: Drilling Method: GeoBoring & Development, Inc.

Reference Elevation: MW - 1 99.84'

Hollow-Stem Auger

MW-2 99.52

#### Well Description

Surface Casing: Flush Mounted

Concrete

Filter Pack: 10 - 20 Silica Sand Seal:

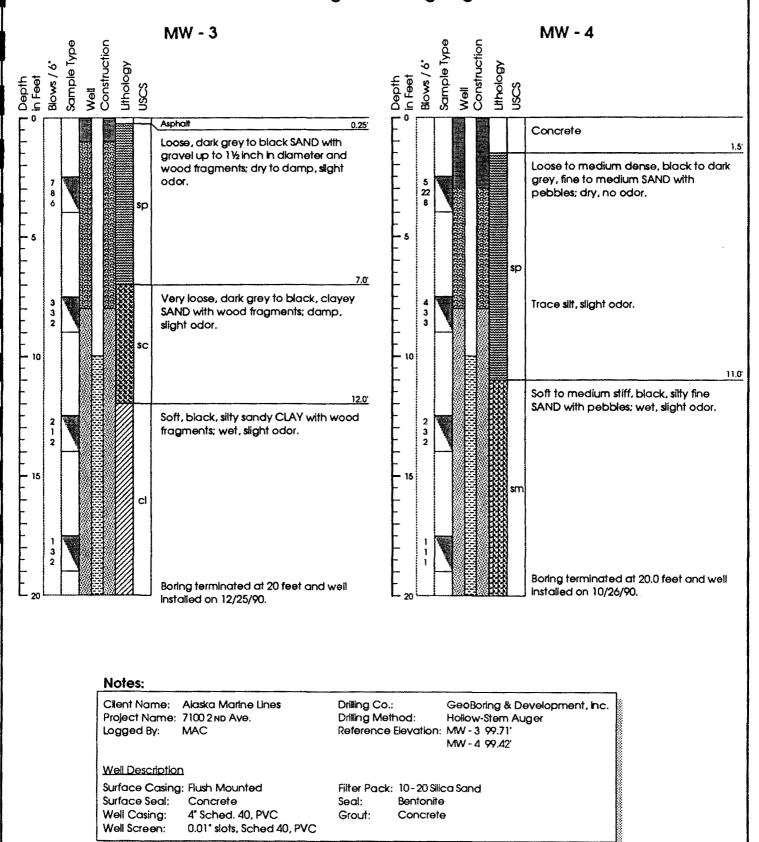
Surface Seal:

**Bentonite** 

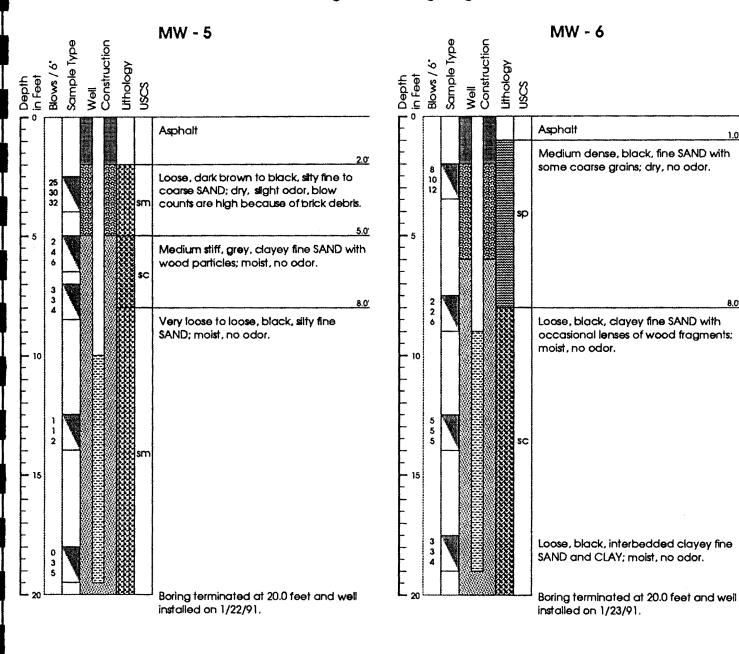
Well Casing: Well Screen:

4" Sched. 40, PVC 0.01" slots, Sched 40, PVC Grout: Concrete

## Monitoring Well Construction and Geological Boring Log



#### Monitoring Well Construction and **Geological Boring Log**



#### Notes:

Client Name: Alaska Marine Lines Project Name: 71002 ND Ave.

Drilling Co.:

GeoBoring & Development, Inc.

Drilling Method:

Hollow-Stem Auger

Logged By: MW Reference Elevation: MW - 5 98.32°

MW - 6 98,43°

#### Well Description

Surface Casing: Flush Mounted Concrete

Fifter Pack: 10-20 Silica Sand

Surface Seal: Well Casing:

4" Sched. 40, PVC

Seal: Bentonite

Well Screen:

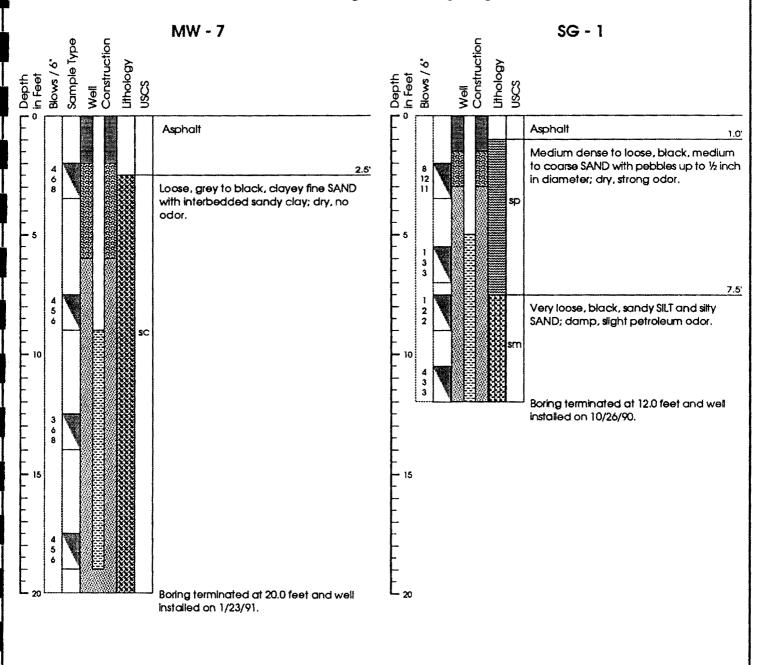
0.01" slots, Sched 40, PVC

Grout: Concrete

Job No. 21048-001-005-

Dames & Moore

### **Monitoring Well Construction and Geological Boring Log**



#### Notes:

Client Name: Alaska Marine Lines Project Name: 71002 ND Ave.

Drilling Co.: GeoBoring & Development, Inc.

Logged By:

Drilling Method: Hollow-Stem Auger

Reference Elevation: MW - 7 99.48'

#### Well Description

Surface Casing: Flush Mounted Filter Pack: 10-20 Silica Sand Surface Seal: Concrete Bentonite Seal: Well Casing: 4" Sched. 40, PVC Grout: Concrete

Well Screen: 0.01° slots, Sched 40, PVC



November 9, 1990

Dames & Moore Attn: Wanda Schulze 500 Market Place Tower 2025 1st Avenue Seattle, WA 98121

IN RE: ALDEN PROJECT NUMBER 9010028/1

Dear Wanda:

I have enclosed the analytical results for the samples submitted to Alden Labs October 25, 1990. The samples were analyzed for TEPH using Method 8015-Modified and BTEX using Method 8240.

It is Alden's policy to dispose of all samples and extracts two weeks from report date unless notified otherwise. If you have any questions please feel free to call me.

Sincerely,

John M. Buerger Laboratory Manager

Enclosures



Client: Dames & Moore

Client Sample Number: See below Date of Sample Receipt: 10/25/90

Matrix: Soil

Alden Job Number: 9010028/1

Alden Sample Number: See below Analysis Method: 8015-Modified

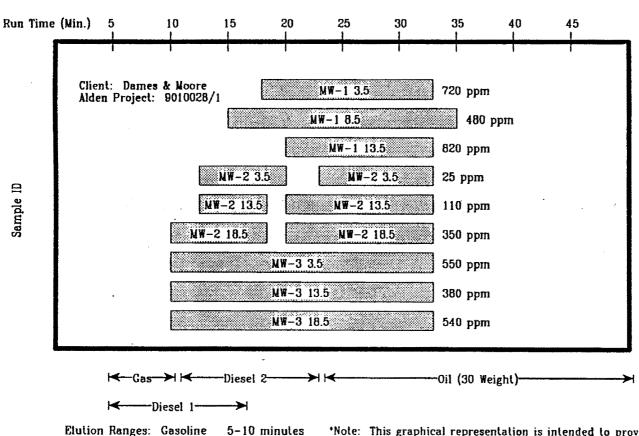
Reporting Units: mg/kg

Client	Alden			
Sample ID	Sample Number	<b>Extraction Date</b>	<u>Analysis Date</u>	Total Extractable Hydrocarbons
N1 / A	Dt f.	11 /0 /00	11 /11 /00	.00
N/A	Blank	11/8/90	11/11/90	< 2.0
MW-1 3.5	5317	11/8/90	11/11/90	720
MW-1 8.5	5318	11/8/90	11/11/90	. 480
MW-1 13.5	5319	11/8/90	11/11/90	820
MW-23.5	5320	11/8/90	11/11/90	25
MW-2 13.5	5321	11/8/90	11/11/90	110
MW-2 18.5	5322	11/8/90	11/11/90	350
MW-3 3.5	5323	11/8/90	11/11/90	550
MW-3 13.5	5324	11/8/90	11/11/90	380
MW-3 18.5	5325	11/8/90	11/11/90	540

Note: Results are reported to two significant figures.



#### TPH (8015-Mod) GRAPHICAL SUMMARY\*



5-17 minutes 10-22 minutes Diesel 1 Diesel 2 0il (30W) 22-50 minutes \*Note: This graphical representation is intended to provide a qualitative measurement of the elution range of hydrocarbons present in the sample versus known petroleum standards.



Client: Dames & Moore

Client Sample Number: MW-1 3.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9010028/1 Alden Sample Number: 5317 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	2.0	< 2.0	
Toluene	108-88-3	2.0	< 2.0	
Ethylbenzene	100-41-4	2.0	< 2.0	
m,p-Xylene*	1330-20-7	2.0	< 2.0	
m,p-Xylene o-Xylene	1330-20-7	2.0	< 2.0	

Percent Recovery
85
110
88

<sup>\*</sup>m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-1 8.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9010028/1 Alden Sample Number: 5318 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	2.0	< 2.0	
Toluene	108-88-3	2.0	< 2.0	
Ethylbenzene	100-41-4	2.0	< 2.0	
m,p-Xylene*	1330-20-7	2.0	< 2.0	
o-Xylene	1330-20-7	2.0	< 2.0	

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	88
Toluene-dg	100
Bromofluorobenzene	93
1	

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-1 13.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Analysis Method: EPA 8240 Matrix: Soil

Reporting Units: ug/kg as received

Alden Job Number: 9010028/1

Alden Sample Number: 5319

Date of Sample Analysis: 11/7/90

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	5.0	< 5.0	
Toluene	108-88-3	5.0	< 5.0	
Ethylbenzene	100-41-4	5.0	< 5.0	
m,p-Xylene*	1330-20-7	5.0	< 5.0	- 1
o-Xylene	1330-20-7	5.0	< 5.0	

Percent Recovery		
88		
100		
94		

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-23.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9010028/1 Alden Sample Number: 5320

Analysis Method: EPA 8240 Matrix: Soil

CAS Number	Detection Limit	Result	
71-43-2	2.0	< 2.0	
108-88-3	2.0	< 2.0	
100-41-4	2.0	< 2.0	
1330-20-7	2.0	< 2.0	
1330-20-7	2.0	< 2.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 2.0 108-88-3 2.0 100-41-4 2.0 1330-20-7 2.0	71-43-2 2.0 <2.0 108-88-3 2.0 <2.0 100-41-4 2.0 <2.0 1330-20-7 2.0 <2.0

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	89
Toluene-d <sub>8</sub>	98
Bromofluorobenzene	97

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-2 13.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9010028/1 Alden Sample Number: 5321 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	****
Benzene	71-43-2	2.0	50	
Toluene	108-88-3	2.0	< 2.0	
Ethylbenzene	100-41-4	2.0	< 2.0	
m,p-Xylene*	1330-20-7	2.0	< 2.0	
o-Xylene	1330-20-7	2.0	< 2.0	

Surrogate Percent Recove	
1,2-Dichloroethane-d <sub>4</sub>	88
Toluene-dg	110
Bromofluorobenzene	95

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-2 18.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/8/90

Alden Job Number: 9010028/1

Alden Sample Number: 5322 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	2.0	< 2.0	
Toluene	108-88-3	2.0	< 2.0	
Ethylbenzene	100-41-4	2.0	< 2.0	
m,p-Xylene	1330-20-7	2.0	< 2.0	
m,p-Xylene o-Xylene	1330-20-7	2.0	< 2.0	

Percent Recovery	
88	
. 100	
94	

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-3 3.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/8/90

Alden Job Number: 9010028/1 Alden Sample Number: 5323 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	2.0	15	
Toluene	108-88-3	2.0	2.3	
Ethylbenzene	100-41-4	2.0	< 2.0	
m,p-Xylene*	1330-20-7	2.0	< 2.0	
o-Xylene	1330-20-7	2.0	< 2.0	

Percent Recovery
86
115
83

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-3 13.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/8/90

Alden Job Number: 9010028/1 Alden Sample Number: 5324 Analysis Method: EPA 8240

Matrix: Soil

CAS Number	Detection Limit	Result	
71-43-2	2.0	28	
108-88-3	2.0	< 2.0	
100-41-4	2.0	< 2.0	
1330-20-7	2.0	< 2.0	
1330-20-7	2.0	< 2.0	
•	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 2.0 108-88-3 2.0 100-41-4 2.0 1330-20-7 2.0	71-43-2 2.0 28 108-88-3 2.0 <2.0 100-41-4 2.0 <2.0 1330-20-7 2.0 <2.0

Percent Recovery			
88			
100			
93			

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-3 18.5 Date of Sample Receipt: 10/25/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/8/90

Alden Job Number: 9010028/1

Alden Sample Number: 5325 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	2.0	< 2.0	
Toluene	108-88-3	2.0	< 2.0	
Ethylbenzene	100-41-4	2.0	< 2.0	
m,p-Xylene*	1330-20-7	2.0	< 2.0	
o-Xylene	1330-20-7	2.0	< 2.0	

Surrogate	Percent Recovery			
1,2-Dichloroethane-d₄	90			
Toluene-dg	100			
Bromofluorobenzene	95			

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-43.5 Date of Sample Receipt: 10/26/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Date of Sample Extraction: N/A Matr

Alden Job Number: 9010031/1 Alden Sample Number: 5358 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	5.0	< 5.0	
Toluene	108-88-3	5.0	< 5.0	
Ethylbenzene	100-41-4	5.0	< 5.0	
m,p-Xylene*	1330-20-7	5.0	< 5.0	
o-Xylene	1330-20-7	5.0	< 5.0	

Surrogate ·	Percent Recovery
1,2-Dichloroethane-d4	87
Toluene-dg	103
Bromofluorobenzene	92

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

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November 12, 1990

Dames & Moore Attn: Wanda Schulze 500 Market Place Tower 2025 1st Avenue Seattle, WA 98121

IN RE: ALDEN PROJECT NUMBER 9010031/1

Dear Wanda:

I have enclosed the analytical results for the samples submitted to Alden Labs October 26, 1990. The samples were analyzed for TEPH using Method 8015-Modified and BTEX using Method 8240.

It is Alden's policy to dispose of all samples and extracts two weeks from report date unless notified otherwise. If you have any questions please feel free to call me.

Sincerely,

John M. Buerger Laboratory Manager

**Enclosures** 



Client: Dames & Moore

Client Sample Number: See below Date of Sample Receipt: 10/26/90

Matrix: Soil

Alden Job Number: 9010031/1

Alden Sample Number: See below Analysis Method: 8015-Modified

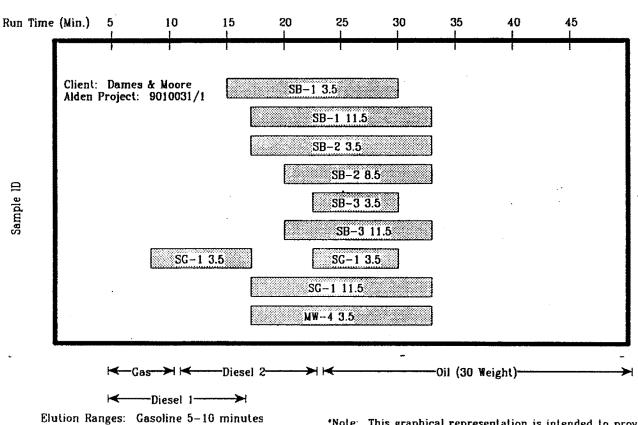
Reporting Units: mg/kg

Client	Alden			
Sample ID	Sample Number	Extraction Date	Analysis Date	Total Extractable Hydrocarbons
N/A	Blank	11/9/90	11/11/90	< 2.0
SB-1 3.5	5347	11/9/90	11/11/90	12
SB-1 11.5	5349	11/9/90	11/11/90	73
SB-23.5	5350	11/9/90	11/11/90	57
SB-2 8.5	5352	11/9/90	11/11/90	350
SB-3 3.5	5353	11/9/90	11/11/90	99
SB-3 11.5	5354	11/9/90	11/11/90	. 31
SG-1 3.5	5355	11/9/90	11/11/90	2800
SG-1 11.5	5357	11/9/90	11/11/90	18
MW-4 3.5	5358	11/9/90	11/11/90	360

Note: Results are reported to two significant figures.



#### TPH (8015-Mod) GRAPHICAL SUMMARY\*



Elution Ranges: Gasoline 5-10 minutes
Diesel 1 5-17 minutes
Diesel 2 10-22 minutes
Oil (30W) 22-50 minutes

\*Note: This graphical representation is intended to provide a qualitative measurement of the elution range of hydrocarbons present in the sample versus known petroleum standards.



Client: Dames & Moore

Client Sample Number: SB-1 3.5
Date of Sample Receipt: 10/26/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5347

Analysis Method: EPA 8240 Matrix: Soil

CAS Number	Detection Limit	Result	
71-43-2	5.0	< 5.0	
108-88-3	5.0	< 5.0	
100-41-4	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 5.0 108-88-3 5.0 100-41-4 5.0 1330-20-7 5.0	71-43-2       5.0       < 5.0

Percent Recovery	
85	
101	
102	

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: SB-1 11.5 Date of Sample Receipt: 10/26/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5349

Analysis Method: EPA 8240 Matrix: Soil

CAS Number	Detection Limit	Result	
71-43-2	5.0	< 5.0	
108-88-3	5.0	< 5.0	
100-41-4	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 5.0 108-88-3 5.0 100-41-4 5.0 1330-20-7 5.0	71-43-2 5.0 < 5.0 108-88-3 5.0 < 5.0 100-41-4 5.0 < 5.0 1330-20-7 5.0 < 5.0

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	87
Toluene-dg	102
Bromofluorobenzene	102
•	102

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: SB-2 3.5 Date of Sample Receipt: 10/26/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5350 Analysis Method: EPA 8240

Matrix: Soil

uit Result	
< 5.0	
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Surrogate	Percent Recovery	
1,2-Dichloroethane-d4	85	
Toluene-dg	102	
Bromofluorobenzene	95	

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore Client Sample Number: SB-2 8.5 Date of Sample Receipt: 10/26/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5352 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	5.0	< 5.0	
Toluene	108-88-3	5.0	< 5.0	
Ethylbenzene	100-41-4	5.0	< 5.0	
m,p-Xylene*	1330-20-7	5.0	< 5.0	
o-Xylene	1330-20-7	5.0	< 5.0	

Percent Recovery
87
100
98

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: SB-3 3.5 Date of Sample Receipt: 10/26/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5353

Analysis Method: EPA 8240

Matrix: Soil

CAS Number	Detection Limit	Result	
71-43-2	5.0	< 5.0	
108-88-3	5.0	< 5.0	
100-41-4	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 5.0 108-88-3 5.0 100-41-4 5.0 1330-20-7 5.0	71-43-2 5.0 < 5.0 108-88-3 5.0 < 5.0 100-41-4 5.0 < 5.0 1330-20-7 5.0 < 5.0

86
00
103
94

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore Client Sample Number: SB-3 11.5 Date of Sample Receipt: 10/26/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5354 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	5.0	< 5.0	
Toluene	108-88-3	5.0	< 5.0	
Ethylbenzene	100-41-4	5.0	< 5.0	
m,p-Xylene	1330-20-7	5.0	< 5.0	
o-Xylene	1330-20-7	5.0	< 5.0	

Percent Recovery
88
98
99

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: SG-1 3.5 Date of Sample Receipt: 10/26/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5355 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS Number	Detection Limit	Result	· · · · · · · · · · · · · · · · · · ·
Benzene	71-43-2	5.0	97	
Toluene	108-88-3	5.0	13	
Ethylbenzene	100-41-4	5.0	< 5.0	
m,p-Xylene <sup>*</sup>	1330-20-7	5.0	18	
m,p-Xylene o-Xylene	1330-20-7	5.0	< 5.0	
*				

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	82
Toluene-d <sub>8</sub>	104
Bromofluorobenzene	95

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: SG-1 11.5 Date of Sample Receipt: 10/26/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/9/90

Alden Job Number: 9010031/1 Alden Sample Number: 5357 Analysis Method: EPA 8240

Matrix: Soil

CAS Number	Detection Limit	Result	
71-43-2	5.0	10	
108-88-3	5.0	< 5.0	
100-41-4	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 5.0 108-88-3 5.0 100-41-4 5.0 1330-20-7 5.0	71-43-2       5.0       10         108-88-3       5.0       < 5.0

Surrogate	Percent Recovery
1,2-Dichloroethane-d <sub>4</sub>	88
Toluene-dg	99
Bromofluorobenzene	98
1	

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



December 21, 1990

Dames & Moore Attn: Sue Kent 500 Market Place Tower 2025 1st Avenue Seattle, WA 98121

IN RE: ALDEN PROJECT NUMBER 9012010/1

Dear Sue:

I have enclosed the analytical results for the samples submitted to Alden on December 13, 1990. The soil samples were analyzed for TEPH using Method 8015-Modified, Volatiles using Method 8240, and PAHs using Method 8270. Dames & Moore sample number SB-5-13 was inadvertently exposed to the extractions laboratory environment resulting in some elevated levels of acetone and methylene chloride.

DEC 31 1990

The original invoice will be sent to your attention at a later date.

It is Alden's policy to dispose of all samples and extracts after the hold time has expired unless notified otherwise. If you have any questions please feel free to contact me.

Sincerely,

John M. Buerger Lab Manager

**Enclosures** 



Client: Dames & Moore

Client Sample Number: See below Date of Sample Receipt: 12/13/90

Matrix: Soil

Alden Job Number: 9012010/1

Alden Sample Number: See below Analysis Method: 8015-Modified

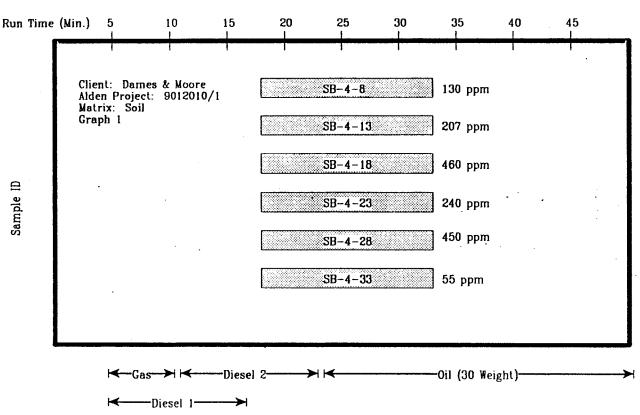
Reporting Units: mg/kg

Client Sample ID	Alden Sample Number	Extraction Date	Analysis Date	Total Extractable Hydrocarbons
N/A	Blank	12/17/90	12/19/90	< 2.0
SB-4-8	5707	12/17/90	12/19/90	130
SB-4-13	5708	12/17/90	12/19/90	207
SB-4-18	5709	12/17/90	12/19/90	460
SB-4-23	5710	12/17/90	12/19/90	240
SB-4-28	5711	12/17/90	12/19/90	450
SB-4-33	5712	12/17/90	12/19/90	55
SB-5-13	5715A	12/17/90	12/19/90	210
SB-5-18	5716A	12/17/90	12/19/90	3600
SB-5-23	5717A	12/17/90	12/19/90	110
SB-5-28	5718A	12/17/90	12/19/90	340
SB-5-33	5719A	12/17/90	12/19/90	59

Note: Results are reported to two significant figures.



#### TPH (8015-Mod) GRAPHICAL SUMMARY\*

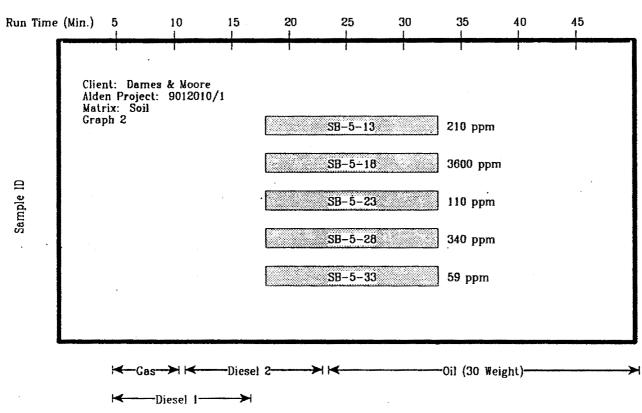


Elution Ranges: Gasoline 5-10 minutes
Diesel 1 5-17 minutes
Diesel 2 10-22 minutes
Oil (30W) 22-50 minutes

\*Note: This graphical representation is intended to provide a qualitative measurement of the elution range of hydrocarbons present in the sample versus known petroleum standards.



### TPH (8015-Mod) GRAPHICAL SUMMARY\*



Elution Ranges: Casoline 5-10 minutes Diesel 1 5-17 minutes Diesel 2 10-22 minutes

0il (30W) 22-50 minutes

\*Note: This graphical representation is intended to provide a qualitative measurement of the elution range of hydrocarbons present in the sample versus known petroleum standards.



Client: Dames & Moore Client Sample Number: N/A Date of Sample Receipt: N/A

Date of Sample Extraction: 12/14/90 Date of Sample Analysis: 12/17/90

Alden Job Number: 9012010/1 Alden Sample Number: Blank Analysis Method: EPA 8270

Matrix: Soil

Compound Name	CAS No.	Reporting Limit	Result
BASE/NEUTRAL EXTRACTABLE COMPO	UNDS		
Acenaphthene	83-32-9	30	< 30
Acenaphthylene	208-96-8	30	< 30
Anthracene	120-12-7	30	< 30
Benzo(a)anthracene	56-55-3	30	< 30
Benzo(b)fluoranthene	205-99-2	60	< 60
Benzo(k)fluoranthene	207-08-9	. 60	·< 60
Benzo(a)pyrene	50-32-8	60	< 60
Benzo(g,h,i)perylene	191-24-2	60	< 60
Chrysene	218-01-9	30	< 30
Dibenzo(a,h)anthracene	53-70-3	60	< 60
Dibenzofuran	132-64-9	30	< 30
Fluoranthene	206-44-0	30	< 30
Fluorene	86-73-7	30	< 30
Indeno(1,2,3-c,d)pyrene	193-39-5	60	< 60 .
2-Methylnaphthalene	91-57-6	30	< 30
Naphthalene	- 91-20-3	30	· < 30
Phenanthrene	85-01-8	30	< 30
Pyrene	129-00-0	30	< 30

Surrogate	Amount Added	Percent Recovery	Recovery Limits
Nitrobenzene-d5	100 ug	67	23-120
2-Fluorobiphenyl	100 ug	67	30-115
p-Terphenyl-d <sub>14</sub>	100 ug	84	18-137
Phenol-d <sub>6</sub>	200 ug	67	24-113
2-Fluorophenol	200 ug	66	25-121
2,4,6-Tribromophenol	200 ug	67	19-122



Client: Dames & Moore

Client Sample Number: SB-4-8 Date of Sample Receipt: 12/13/90

Date of Sample Extraction: 12/14/90

Date of Sample Analysis: 12/17/90

Alden Job Number: 9012010/1 Alden Sample Number: 5707 Analysis Method: EPA 8270

Matrix: Soil

Compound Name	CAS No.	Reporting Limit	Result
BASE/NEUTRAL EXTRACTABLE COMPO	DUNDS		
Acenaphthene	83-32-9	40	< 40
Acenaphthylene	208-96-8	40	< 40
Anthracene	120-12-7	40	< 40
Benzo(a)anthracene	56-55-3	40	< 40
Benzo(b)fluoranthene	205-99-2	80	< 80
Benzo(k)fluoranthene	207-08-9	80	< 80
Benzo(a)pyrene	50-32-8	80	< 80
Benzo(g,h,i)perylene	191-24-2	80	< 80
Chrysene	218-01-9	40	< 40
Dibenzo(a,h)anthracene	53-70-3	.80	< 80
Dibenzofuran	: 132-64-9	40	< 40
Fluoranthene	206-44-0	40	< 40
Fluorene	86-73-7	40	< 40
Indeno(1,2,3-c,d)pyrene	193-39-5	80	. < 80
2-Methylnaphthalene	91-57-6	40	< 40
Naphthalene	- 91-20-3	40	< 40
Phenanthrene	85-01-8	40	< 40
Pyrene	129-00-0	40	< 40

Surrogate	Amount Added	Percent Recovery	Recovery Limits
Nitrobenzene-d5	100 ug	<b>7</b> 5	23-120
2-Fluorobiphenyl	100 ug	81	30-115
p-Terphenyl-d <sub>14</sub>	100 ug	85	18-137
Phenol-d <sub>6</sub>	200 ug	80	24-113
2-Fluorophenol	200 ug	<i>7</i> 5	25-121
2,4,6-Tribromophenol	200 ug	78	, 19-122



Client: Dames & Moore

Client Sample Number: SB-5-13 Date of Sample Receipt: 12/13/90

Date of Sample Extraction: 12/14/90 Date of Sample Analysis: 12/17/90

Alden Job Number: 9012010/1 Alden Sample Number: 5715A

Analysis Method: EPA 8270 Matrix: Soil

Compound Name	CAS No.	Reporting Limit	Result
BASE/NEUTRAL EXTRACTABLE COMPOU	INDS		
Acenaphthene	83-32-9	50	< 50
Acenaphthylene	208-96-8	50	< 50
Anthracene	120-12-7	50	< 50
Benzo(a)anthracene	56-55-3	50	< 50
Benzo(b)fluoranthene	205-99-2	100 ·	< 100
Benzo(k)fluoranthene	207-08-9	100	< 100
Benzo(a)pyrene	50-32-8	100	< 100
Benzo(g,h,i)perylene	191 <b>-24-</b> 2	100	< 100
Chrysene	218-01-9	50	< 50
Dibenzo(a,h)anthracene	53-70-3	100	< 100
Dibenzofuran	132-64-9	50	< 50
Fluoranthene	206-44-0	50	56
Fluorene	86-73-7	50	< 50
Indeno(1,2,3-c,d)pyrene	193-39-5	100	< 100
2-Methylnaphthalene	91-57-6	50	< 50
Naphthalene -	91-20-3	50	< 50
Phenanthrene	85-01-8	50	65
Pyrene	129-00-0	50	70

Surrogate	Amount Added	Percent Recovery	Recovery Limits
Nitrobenzene-d5	100 ug	50	23-120
2-Fluorobiphenyl	100 ug	66	30-115
p-Terphenyl-d <sub>14</sub>	100 ug	82	18-137
Phenol-d <sub>6</sub>	200 ug	53	24-113
2-Fluorophenol	200 ug	48	25-121
2,4,6-Tribromophenol	200 ug	<b>7</b> 9	19-122



Client: Dames & Moore

Client Sample Number: SB-4-8
Date of Sample Receipt: 12/13/90
Date of Sample Extraction: N/A

Date of Sample Analysis: 12/18/90

Alden Job Number: 9012010/1 Alden Sample Number: 5707 Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS No.	Reporting Limit	Result
Acetone	67-64-1	10	220
Benzene	71-43-2	1.0	< 1.0
Bromodichloromethane	75-27-4	1.0	< 1.0
Bromoform	75-25-2	1.0	< 1.0
Bromomethane	<b>74-83-</b> 9	1.0	< 1.0
2-Butanone	78-93-3	10	< 10
Carbon disulfide	<i>7</i> 5-15-0	1.0	< 1.0
Carbon tetrachloride	56-23-5	1.0	< 1.0
Chlorobenzene	108-90-7	1.0	< 1.0
Chloroethane	75-00-3	1.0	< 1.0
Chloroform	67-66-3	1.0	< 1.0
Chloromethane	74-87-3	1.0	< 1.0
Dibromochloromethane	124-48-1	1.0	< 1.0
1,2-Dichlorobenzene	95-50-1	1.0	< 1.0
1,3-Dichlorobenzene	541-73-1	1.0	< 1.0
1,4-Dichlorobenzene	106-46-7	1.0	< 1.0
1,1-Dichloroethane	75-34-3	1.0	< 1.0
1,2-Dichloroethane	107-06-2	1.0	< 1.0
1,1-Dichloroethene	75-35-4	1.0	< 1.0
cis-1,2-Dichloroethene	156-60-5	1.0	< 1.0
trans-1,2-Dichloroethene	156-60-5	1.0	< 1.0
1,2-Dichloropropane	78-87-5	1.0	< 1.0
cis-1,3-Dichloropropene	10061-01-5	1.0	< 1.0
trans-1,3-Dichloropropene	10061-02-6	1.0	< 1.0
Ethylbenzene	100-41-4	1.0	< 1.0
2-Hexanone	591-78-6	10	< 10
Methylene chloride	75-09-2	10	110
4-Methyl-2-Pentanone	108-10-1	10	< 10
Styrene	100-42-5	1.0	< 1.0
1,1,2,2-Tetrachloroethane	79-34-5	1.0	< 1.0
Tetrachlorethene	127-18-4	1.0	< 1.0
Toluene	108-88-3	1.0	< 1.0
1,1,1-Trichloroethane	71-55-6	1.0	< 1.0
1,1,2-Trichloroethane	79-00-5	1.0	< 1.0
Trichloroethene	79-01-6	1.0	< 1.0
Trichlorofluoromethane	75-69-4	10	< 10
Vinyl acetate	108-05-4	10	< 10
Vinyl chloride	75-01-4	1.0	< 1.0
o-Xylene	1330-20-7	1.0	< 1.0
m,p-Xylene*	1330-20-7	1.0	< 1.0
			~ 4.17



Client: Dames & Moore

Client Sample Number: SB-4-8
Date of Sample Receipt: 12/13/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/18/90

Alden Job Number: 9012010/1

Alden Sample Number: 5707 Analysis Method: EPA 8240

Matrix: Soil

Surrogate	Amount Added	Percent Recovery	Recovery Limits
1,2-Dichloroethane-d4	250 ng	110	86-115
Toluene-dg	250 ng	100	76-114
Bromofluorobenzene	250 ng	94	88-110

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: SB-5-13
Date of Sample Receipt: 12/13/90
Date of Sample Extraction: N/A

Date of Sample Analysis: 12/18/90

Alden Job Number: 9012010/1 Alden Sample Number: 5715B Analysis Method: EPA 8240

Matrix: Soil

Compound Name	CAS No.	Reporting Limit	Result	
Acetone	67-64-1	10	94	
Benzene	71-43-2	1.0	< 1.0	
Bromodichloromethane	75-27-4	1.0	< 1.0	
Bromoform	75-25-2	1.0	< 1.0	
Bromomethane	74-83-9	1.0	< 1.0	
2-Butanone	78-93-3	10	< 10	
Carbon disulfide	75-15-0	1.0	< 1.0	
Carbon tetrachloride	56-23-5	1.0	< 1.0	
Chlorobenzene	108-90-7	1.0	< 1.0	
Chloroethane	75-00-3	1.0	< 1.0	
Chloroform	67-66-3	1.0	< 1.0	
Chloromethane	74-87-3	1.0	< 1.0	
Dibromochloromethane	124-48-1	1.0	< 1.0	
1,2-Dichlorobenzene	95-50-1	1.0	< 1.0	
1,3-Dichlorobenzene	541-73-1	1.0	< 1.0	
1,4-Dichlorobenzene	106-46-7	1.0	< 1.0	
1,1-Dichloroethane	75-34-3	1.0	< 1.0	
1,2-Dichloroethane	107-06-2	1.0	< 1.0	
1,1-Dichloroethene	75-35-4	1.0	< 1.0	
cis-1,2-Dichloroethene	156-60-5	1.0	< 1.0	
trans-1,2-Dichloroethene	156-60-5	1.0	< 1.0	
1,2-Dichloropropane	78-87-5	1.0	< 1.0	
cis-1,3-Dichloropropene	10061-01-5	1.0	< 1.0	
trans-1,3-Dichloropropene	10061-02-6	1.0	< 1.0	
Ethylbenzene	100-41-4	1.0	< 1.0	
2-Hexanone	591 <b>-7</b> 8-6	10	< 10	
Methylene chloride	75-09-2	10	54	
4-Methyl-2-Pentanone	108-10-1	10	< 10	
Styrene	100-42-5	1.0	< 1.0	
1,1,2,2-Tetrachloroethane	79-34-5	1.0	< 1.0	
Tetrachlorethene	127-18-4	1.0	< 1.0	
Toluene	108-88-3	1.0	< 1.0	
1,1,1-Trichloroethane	<b>71-55-6</b>	1.0	< 1.0	
1,1,2-Trichloroethane	<b>7</b> 9-00-5	1.0	< 1.0	
Trichloroethene	79-01-6	1.0	< 1.0	
Trichlorofluoromethane	<b>75-69-4</b>	10	< 10	
Vinyl acetate	108-05-4	10	< 10	
Vinyl chloride	75-01- <del>4</del>	1.0	< 1.0	
o-Xylene	1330-20-7	1.0	< 1.0	
m,p-Xylene*	1330-20-7	1.0	< 1.0	



Client: Dames & Moore

Client Sample Number: SB-5-13 Date of Sample Receipt: 12/13/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/18/90

Alden Job Number: 9012010/1

Alden Sample Number: 5715B Analysis Method: EPA 8240

Matrix: Soil

Surrogate	Amount Added	Percent Recovery	Recovery Limits
1,2-Dichloroethane-d4	250 ng	110	86-115
Toluene-dg	250 ng	110	76-114
Bromofluorobenzene	250 ng	94	88-110

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

# DAMES & MOORE

Chain of Custody

Date 12 / 7 / 9 Page / of 2

500 Market Place Tower • 2025 First Avenue • Seattle, Washington 98121 • (206) 728-0744

rioject Number. —		4000							. 8	<b></b>	Ana	lysis	Req	uest			<b>.</b>				4.5	
Project Manager: — Laboratory: — Turn around time: —		10 In		SS (SW	olatiles	les .	ં cids MS)		natic 610/8310	***		\$ ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (			100				Comr	ments/	Containers	
Sampler's Initials: — Sampler's Signature: —	767 Y	υ Μυα	JU1	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatites 601/8010	Aromatic Volatiles 602/8020	Base/Neutral/Acids 625/8270 (GC/MS)	BTX 602/8015	Potycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8080					rity Pollutau als (13) ≗	TOX Metal				ictions	Number of Co	
Sample ID	Date	Time	Matrix	Vola 624/	Halo 601/	Aron 602/	Base 625/	XT8	충호	Pess 608/		la <sub>n</sub> t,		, +\$	Priority Metals	8 ⊞					Ž	
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Special Instructions/Cor	nments			Relin	nquish	ed by:			1	1	Rece	eived b	y (lab	<b>)</b> :				S	ample	Receip	t 📑	
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Chain of Custody

Date 1217190 Page 2 of 2

500 Market Place Tower • 2025 First Avenue • Seattle, Washington 98121 (206) 728-0744

Project Number: 2104 5 001 Analysis Request Project Manager: -Mde-Laboratory: Halogenated Volatiles 601/8010 Pesticides/PCBs and 608/8080 Turn around time: Comments/ BTX 602/8015 Instructions Sampler's Initials: 211Williams Sampler's Signature: -Sample ID Date **⊞** ⊛ Time Matrix 12/6/20an Soil 33 HW6. 12/7/90 am MW-6-11W-6ain Sample Receipt Special Instructions/Comments: Relinquished by: Received by (lab): Total no. of containers: Chain of custody seals: Rec'd good condition/cold: (Company) (Company) Conforms to record: (Time) 14 ab number:



November 15, 1990

Dames & Moore Attn: Sue Kent 500 Market Place Tower 2025 1st Avenue Seattle, WA 98121

IN RE: ALDEN PROJECT NUMBER 9011003/1

Dear Sue:

I have enclosed the analytical results for the samples submitted to Alden Labs November 1, 1990. The samples were analyzed for TEPH using Method 8015-Modified and BTEX using Method 8240.

It is Alden's policy to dispose of all samples and extracts two weeks from report date unless notified otherwise. If you have any questions please feel free to call me.

Sincerely,

John M. Buerger Laboratory Manager

**Enclosures** 



Client: Dames & Moore

Client Sample Number: See below Date of Sample Receipt: 11/1/90

Matrix: Water

Alden Job Number: 9011003/1 Alden Sample Number: See below Analysis Method: 8015-Modified

Reporting Units: mg/L

Client Sample ID	Alden <u>Sample Number</u>	Extraction Date	Analysis Date	Total Extractable Hydrocarbons
N/A	Blank	11/1/90	11/8/90	< 0.05
MW-1	5400C	11/1/90	11/8/90	0.59
MW-2	5401C	11/1/90	11/8/90	0.56
MW-3	5402C	11/1/90	11/8/90	0.33
MW-4	5403C	11/1/90	11/8/90	0.27

Note: Results are reported to two significant figures.



Client: Dames & Moore Client Sample Number: N/A

Client Sample Number: N/A
Date of Sample Receipt: N/A

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9011003/1 Alden Sample Number: Blank

Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	1.0	< 1.0	
Toluene	108-88-3	1.0	< 1.0	
Ethylbenzene	100-41-4	1.0	< 1.0	
m,p-Xylene*	1330-20-7	1.0	< 1.0	
o-Xylene	1330-20-7	1.0	< 1.0	

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	100
Toluene-d <sub>8</sub>	99
Bromofluorobenzene	98

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-1

Date of Sample Receipt: 11/1/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9011003/1 Alden Sample Number: 5400A

Analysis Method: EPA 624 Matrix: Water

CAS Number	Detection Limit	Result	
71-43-2	1.0	< 1.0	
108-88-3	1.0	< 1.0	
100-41-4	1.0	< 1.0	
1330-20-7	1.0	< 1.0	
1330-20-7	1.0	< 1.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 1.0 108-88-3 1.0 100-41-4 1.0 1330-20-7 1.0	71-43-2 1.0 <1.0 108-88-3 1.0 <1.0 100-41-4 1.0 <1.0 1330-20-7 1.0 <1.0

-	Surrogate		Percent Recovery
	1,2-Dichloroethane-d4		86
١	Toluene-dg		100
1	Bromofluorobenzene	•	100
- 1			

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-2

Date of Sample Receipt: 11/1/90 Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9011003/1 Alden Sample Number: 5401A Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Detection Limit	Result
Benzene	71-43-2	1.0	< 1.0
Toluene	108-88-3	1.0	< 1.0
Ethylbenzene	100-41-4	1.0	< 1.0
	1330-20-7	1.0	< 1.0
m,p-Xylene o-Xylene	1330-20-7	1.0	< 1.0

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	88
Toluene-dg	98
Bromofluorobenzene	100

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-3

Date of Sample Receipt: 11/1/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9011003/1 Alden Sample Number: 5402A

Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Detection Limit	Result
Benzene	71-43-2	1.0	< 1.0
Toluene	108-88-3	1.0	< 1.0
Ethylbenzene	100-41-4	1.0	1.1
m,p-Xylene*	1330-20-7	1.0	5.3
o-Xylene	1330-20-7	1.0	< 1.0
•			

Surrogate	Percent Recovery
1,2-Dichloroethane-d <sub>4</sub>	87
Toluene-dg	100
Bromofluorobenzene	100
1	

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-4 Date of Sample Receipt: 11/1/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9011003/1 Alden Sample Number: 5403A

Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	100	4200	
Toluene	108-88-3	1.0	8.3	
Ethylbenzene	100-41-4	1.0	2.1	
	1330-20-7	1.0	< 1.0	
m,p-Xylene* o-Xylene	1330-20-7	1.0	4.2	

Percent Recovery
8 <b>9</b>
. <b>99</b>
100

<sup>\*</sup>m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: Duplicate Date of Sample Receipt: 11/1/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9011003/1

Alden Sample Number: 5405A Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Detection Limit	Result	
Benzene	71-43-2	100	3700	
Toluene	108-88-3	1.0	6.9	
Ethylbenzene	100-41-4	1.0	1.4	
m,p-Xylene*	1330-20-7	1.0	1.9	
o-Xylene	1330-20-7	1.0	4.0	

Percent Recovery							
86							
98							
99							

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: Rinsate Date of Sample Receipt: 11/1/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 11/7/90

Alden Job Number: 9011003/1

Alden Sample Number: 5404A

Analysis Method: EPA 624

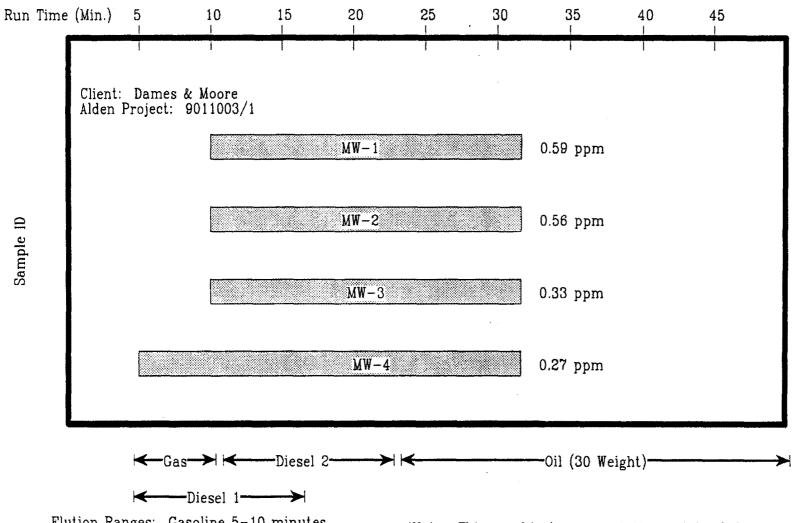
Matrix: Water

Compound Name	CAS Number	Detection Limit	Result		
Benzene	71-43-2	1.0	< 1.0		
Toluene	108-88-3	1.0	< 1.0		
Ethylbenzene	100-41-4	1.0	< 1.0		
m,p-Xylene*	1330-20-7	1.0	< 1.0		
o-Xylene	1330-20-7	1.0	< 1.0		

Percent Recovery
90
99
100

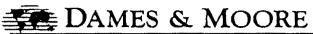
<sup>\*</sup>m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

# TPH (8015-Mod) GRAPHICAL SUMMARY\*



Elution Ranges: Gasoline 5-10 minutes
Diesel 1 5-17 minutes
Diesel 2 10-22 minutes
Oil (30W) 22-50 minutes

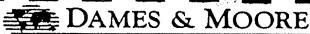
\*Note: This graphical representation is intended to provide a qualitative measurement of the elution range of hydrocarbons present in the sample versus known petroleum standards.



# Chain of Custody Date // // 90 Page /- of \_\_\_

500 Market Place Tower • 2025 First Avenue • Seattle, Washington 98121 • (206) 728-0744

Project Number: _	210-19 +110-Ve	$\frac{100}{100}$	STEAN	5052 <i>∞</i> 5					Analysis Request											
Project Number: Project Manager: Laboratory: _	Alder				se			K.	310											sıs
Turn around time:	tanda	rd		ics (MS)	/olatile	ijes	Acids (MS)	3	matic 610/6	B					ŧ	s			Comments/	ntaine
Sampler's Initials: Sampler's Signature:	JHW	Tillian	ms	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Aromatic Volatiles 602(8020)	Base/Neutral/Acids 625/8270 (GC/MS)	BTX 602(8015)	Polycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8080					Priority Pollutant Metals (13)	EP TOX Metals (8)			Instructions	Number of Containers
Sample ID	Date	Time	Matrix	Volar 624/8	Halo 601/	Aron 602	Base 625/1	хта	Poly <sub>r</sub> Hydr	Pest 608/1					Prior Meta	EP T				Num
MW1	11/1/9	1:20	water			х		×												4
MWZ	и	140	и			Х		λ												4 4 4
MW3	ų	150	ν			×		K		,				·						4
MW4	u	2:10	И			х		λ												4
MW4 Misate Supurate	и	2:05	и			×		7/4												2
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Special Instructions/Co	omments	:			nquish		11		•			ived b	y (lab)	): v. L.				<del></del>	ample Receip	$\neg \neg \neg$
				(Sig)	1/6	1 W	VII	ihs			(Sig)	D	4-51	Was					Total no, of containers	
				(Prin	nted)	Ingr	d W	<u>'Illia</u>	MS		(Printed) Zryan Gruham (Company) AAL						l	Chain of custody seals		
				(Cor	npany)	124	mes	7	Morre		(Con	npany)	AF	<u>rl</u>				Hec	d good condition/cold Conforms to record	
				(Tim	nted) — npany) npany)	00 pm	<u> </u>	_ (Date	e) <u>W/                                   </u>	190	(Time	e) <u>3</u> .	04		.(Date	) 1	190	Lab n	umber:	



Chain of Custody

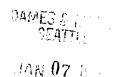
Date 1 190 Page 1 of 1

DAMES & MOORE

500 Market Place Tower • 2025 First Avenue • Seattle, Washington 98121 • (206) 728-0744

Project Number: _	2104°	1001_	SERVED.	505.	2 00	<u>ら</u>		\$			Ana	lysis	Req	uest						╛╽
Project Number: Project Manager: Laboratory: Turn around time: -	Alder	/d		κ (Si	olatiles	es	cids VS)		natic 310/8310	Ş					<b>1</b>				Comments/	tainers
Sampler's Initials: - Sampler's Signature: -	JHW	lluar	w	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Aromatic Volatiles 602(8020)	Base/Neutral/Acids 625/8270 (GC/MS)	BTX 602(8015)	Polycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8080		The state of the s		-	Priority Pollutant Metals (13)	TOX Metals			Instructions	Number of Containers
Sample ID	Date	Time	Matrix	Vola 624//	Halo 601/	Aron 602	Base 625/1	ξ	Poly Hydr	Pest 608/4				,	Prior Meta	EP 7 (8)			-	Num
MWI	11/1/9	120	WOLF			Х		X												4
NWZ	,	140				χ		χ												4
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Special Instructions/Co	mments:			Relin	equished)	ed by:	7 14	2	A.		Rece	eived b	y (lab)	): ,				Sa	ample Receip	t
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			55 12.	(Prin	( <del>C</del> O)	6	1000	*	11	<del></del>	(Prin	rea)	AI	nan (	HITMY	<u> </u>	<del></del>	Rec	'd good condition/cold	
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			April 7	(11m	e)	1110	`	- (Date	e) <u>''</u> -'	<del>/_</del>	(TIM	e)	<u> </u>		- (Date	) <del>1,(</del> 1	1-	Lab n	umber:	





December 27, 1990

Dames & Moore Attn: Sue Kent 500 Market Place Tower 2025 1st Avenue Seattle, WA 98121

IN RE: ALDEN PROJECT NUMBER 9012021/1

Dear Sue:

I have enclosed the analytical results for the water samples submitted to Alden on December 18, 1990. The samples were analyzed BTEX using Method 624.

The original invoice will be sent to your attention at a later date.

It is Alden's policy to dispose of all samples and extracts after the hold time has expired unless notified otherwise. If you have any questions please feel free to contact me.

Sincerely,

John M. Buerger Lab Manager

**Enclosures** 



Client: Dames & Moore

Client Sample Number: N/A

Date of Sample Receipt: N/A

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/21/90

Alden Job Number: 9012021/1 Alden Sample Number: Blank 1

Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Reporting Limit	Result	
Benzene	71-43-2	1.0	< 1.0	l
Toluene	108-88-3	1.0	< 1.0	1
Ethylbenzene	100-41-4	1.0	< 1.0	
m,p-Xylene*	1330-20-7	1.0	< 1.0	į
o-Xylene	1330-20-7	1.0	< 1.0	i
		,		i

Percent Recovery							
110							
100							
94							

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: Blank

Date of Sample Receipt: 12/18/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/21/90

Alden Job Number: 9012021/1

Alden Sample Number: 5945A Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Reporting Limit	Result	
Benzene	71-43-2	1.0	< 1.0	
Toluene	108-88-3	1.0	< 1.0	
Ethylbenzene	100-41-4	1.0	1.4	
m,p-Xylene*	1330-20-7	1.0	< 1.0	
m,p-Xylene o-Xylene	1330-20-7	1.0	< 1.0	

Surrogate	Percent Recovery
1,2-Dichloroethane-d <sub>4</sub>	84
Toluene-dg	98
Bromofluorobenzene	91

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore
Client Sample Number: N/A
Date of Sample Receipt: N/A

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/22/90

Alden Job Number: 9012021/1 Alden Sample Number: Blank 2

Analysis Method: EPA 624

Matrix: Water

CAS Number	Reporting Limit	Result	
71-43-2	1.0	< 1.0	
108-88-3	1.0	< 1.0	
100-41-4	1.0	< 1.0	
1330-20-7	1.0	< 1.0	
1330-20-7	1.0	< 1.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 1.0 108-88-3 1.0 100-41-4 1.0 1330-20-7 1.0	71-43-2 1.0 < 1.0 108-88-3 1.0 < 1.0 100-41-4 1.0 < 1.0 1330-20-7 1.0 < 1.0

Percent Recovery	
86	
100	
93	

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-3

Date of Sample Receipt: 12/18/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/21/90

Alden Job Number: 9012021/1 Alden Sample Number: 5939A, B

Analysis Method: EPA 624

Matrix: Water

CAS Number	Reporting Limit	Result	
71-43-2	5.0	#420	
108-88-3	1.0	3.5	
100-41-4	1.0	13	
1330-20-7	1.0	45	
1330-20-7	1.0	3.4	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 5.0 108-88-3 1.0 100-41-4 1.0 1330-20-7 1.0	71-43-2 5.0 #420 108-88-3 1.0 3.5 100-41-4 1.0 13 1330-20-7 1.0 45

Surrogate	Percent Recovery
1,2-Dichloroethane-d <sub>4</sub>	80
Toluene-dg	100
Bromofluorobenzene	95
I .	

<sup>\*</sup>m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.

# Initial analysis did not meet QC requirements for this analyte. Subsequent analysis was acceptable.



Client: Dames & Moore

Client Sample Number: MW-4 Date of Sample Receipt: 12/18/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/22/90

Alden Job Number: 9012021/1 Alden Sample Number: 5940A Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Reporting Limit	Result	
Benzene	71-43-2	50	3600	
Toluene	108-88-3	50	< 50	
Ethylbenzene	100-41-4	50	< 50	
m,p-Xylene*	1330-20-7	50	63	
o-Xylene	1330-20-7	50	< 50	
m,p-Xylene	·			

Surrogate	Percent Recovery	
1,2-Dichloroethane-d <sub>4</sub>	89	
Toluene-dg	<b>99</b>	
Bromofluorobenzene	95	

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-4 Dup Date of Sample Receipt: 12/18/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/22/90

Alden Job Number: 9012021/1 Alden Sample Number: 5941A Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Reporting Limit	Result	
Benzene	71-43-2	50	4100	
Toluene	108-88-3	50	< 50	
Ethylbenzene	100-41-4	50	< 50	
m,p-Xylene*	1330-20-7	50	64	
o-Xylene	1330-20-7	50	< 50	

Surrogate	Percent Recovery
1,2-Dichloroethane-d <sub>4</sub>	88
Toluene-dg	100
Bromofluorobenzene	96
•	

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-5

Date of Sample Receipt: 12/18/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/22/90

Alden Job Number: 9012021/1 Alden Sample Number: 5942A

Analysis Method: EPA 624 Matrix: Water

Compound Name	CAS Number	Reporting Limit	Result	
Benzene	71-43-2	5.0	< 5.0	
Toluene	108-88-3	5.0	< 5.0	
Ethylbenzene	100-41-4	5.0	< 5.0	
m.p-Xylene*	1330-20-7	5.0	< 5.0	1
o-Xylene	1330-20-7	5.0	< 5.0	

Percent Recovery
91
100
99

<sup>\*</sup> m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-6 Date of Sample Receipt: 12/18/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/22/90

Alden Job Number: 9012021/1 Alden Sample Number: 5943A Analysis Method: EPA 624

Matrix: Water

Compound Name	CAS Number	Reporting Limit	Result	
Benzene	71-43-2	5.0	< 5.0	
Toluene	108-88-3	5.0	< 5.0	
Ethylbenzene	100-41-4	5.0	< 5.0	
m,p-Xylene*	1330-20-7	5.0	< 5.0	
o-Xylene	1330-20-7	5.0	< 5.0	

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	89
Toluene-dg	· 98
Bromofluorobenzene	95
bromondorobenzene	<b>93</b> .

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Client: Dames & Moore

Client Sample Number: MW-7

Date of Sample Receipt: 12/18/90

Date of Sample Extraction: N/A

Date of Sample Analysis: 12/22/90

Alden Job Number: 9012021/1 Alden Sample Number: 5944A

Analysis Method: EPA 624

Matrix: Water

CAS Number	Reporting Limit	Result	,
71-43-2	5.0	< 5.0	
108-88-3	5.0	< 5.0	
100-41-4	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
1330-20-7	5.0	< 5.0	
	71-43-2 108-88-3 100-41-4 1330-20-7	71-43-2 5.0 108-88-3 5.0 100-41-4 5.0 1330-20-7 5.0	71-43-2 5.0 < 5.0 108-88-3 5.0 < 5.0 100-41-4 5.0 < 5.0 1330-20-7 5.0 < 5.0

Surrogate	Percent Recovery
1,2-Dichloroethane-d4	88
Toluene-dg	99
Bromofluorobenzene	94

m-Xylene and p-xylene cannot be separated and are reported here as a total of the two isomers.



Chain of Custody

Date\_\_\_/\_\_ Page \_\_\_ of \_\_\_

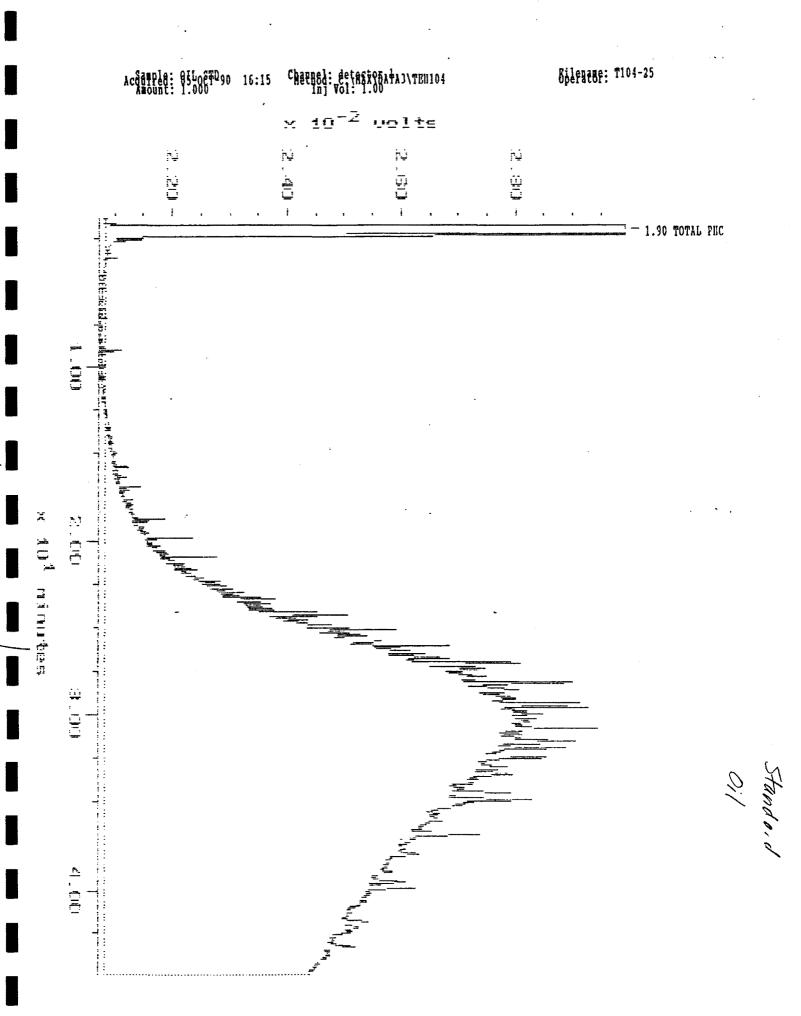
Project Number: 21048-001			135	Analysis Request																
Project Manager: — Laboratory: — Turn around time: —	ory: 4LVEN			88) (S)	olatiles	88	Sids (S)		natic / 7	9	8020							-	Comments/	itainers
Sampler's Initials: — Sampler's Signature: —	Denil		<u> </u>	Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Aromatic Volatiles 602/8020	Base/Neutral/Acids 625/8270 (GC/MS)	BTX 602/8015	Polycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8680	DETX 8		•		Priority Pollutant Metals (13)	TOX Metals			Instructions	Number of Containers
Sample ID	Date	Time	Matrix	Vola 624/	Halo 601/	Aron 602/	Base 625/1	BTX	Poly	Pest 608/	7				Prior Weta	EP 1	·	-		N Fo
mw3	12-181	resi	wh	5.20				\$1.7°	Y											2
mw-4		pm :	36.1	32	1 Kg			Ŷ.	7. 2.1 X							-	<u>.</u>			2
mw-4 Dup		335						\$		S <sub>ec</sub>										2
mW-5		Am		144.				(1) (2)												2.
M W-6		Am.	13. 18. 18.							* :										2
mw-7		Am						\$4	in the second											2
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		-6355	1. 13.	m, 1.		Ç.Ş		***			,									
Special Instructions/Comments:		Relinquished by:						Received by (lab):						Sample Receipt		t				
ANY GUESILON			1. 7 1. 7	(0)-		1.	11.	at .		1	(0:)				<i>,</i>				Total no. of containers	ş:
Special Instructions/Comments:  ANY JUGATUS -  WH GUILLE G		(Sig) Jane Will even. (Printed) DANH & WATTOKON							(Sig) (Printed) AAL)							Chain of custody seals:  Rec'd good condition/cold:		s:		
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				(Con	(Company) (DAM / S & MOOKE (Time) 1600 (Date)/1-16-90							(Company) (Time) 1600 (Date) 12/17/20						Conforms to record:		
				(Time	e)- <u>∱</u> æ			- (Dat	e)/ <u>+_1</u> 0	<u> </u>	(Time	B)	<u> </u>		_(Date	9)_15/-	7.	Lab n	iumber:	

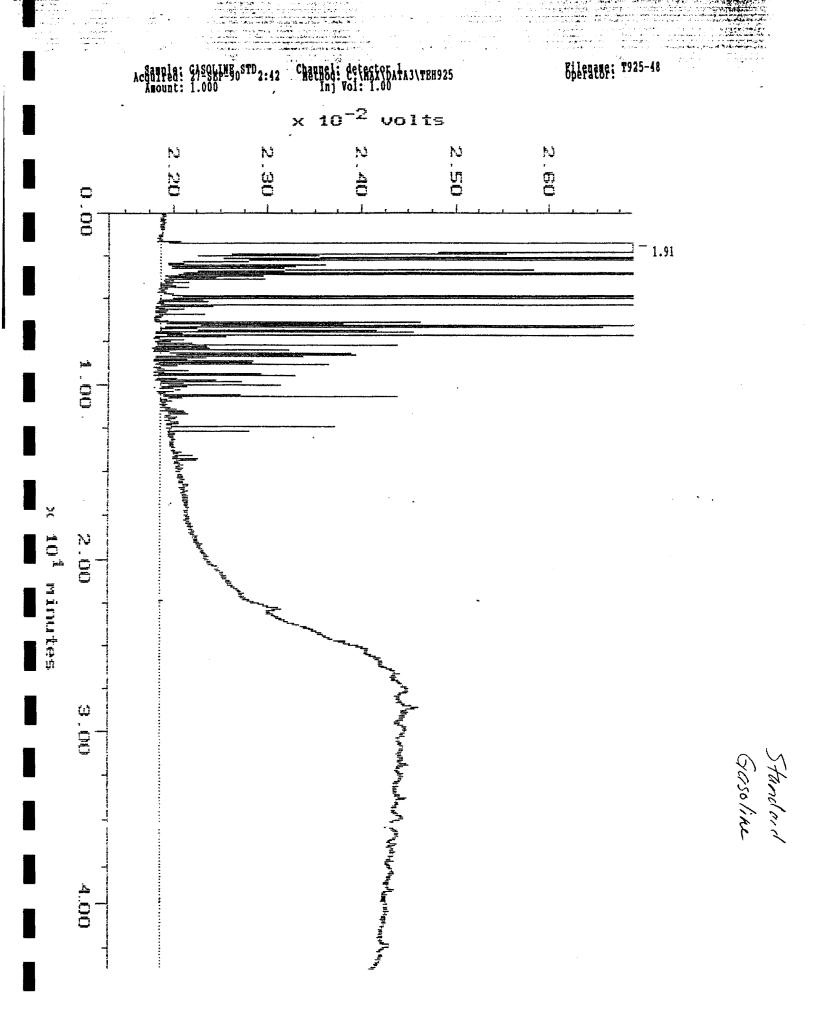
Rilename: T925-50 Operator: Sample: DIBSEL #18TD Sample: Acquired: 27-SEP-90 4 Amount: 1.000 Channel: detector 1
Method: C:\MAX\DATA3\TEH925
Inj Vol: 1.00 4:23  $10^{-2}$  volts 2.30 N 년. 60 00 N N . ហ **០** N 1.91 . 101 minutes 

Standard Diesel #1

Filename: T925-49 Operator: Sample: DIBSEL #2STD Acquired: 27-SEP-90 3 Amount: 1.000 Channel: detector 1
Method: C:\MAX\DATA3\TEH925
Inj Vol: 1.00 3:32 10-2 volts N ..... N. NO N 101 Minutes 2.00 00 

Stundard Diesel # 2





Filename: Tili1-20 Operator: Sample: 5317 1:10 Channel: detector 1
Acquired: 11-NOV-90 13:52 Method: C:\MAX\DATAJ\TEN1111
Amount: 1.000 Inj Vol: 1.00  $\times 10^{-2}$ uelt= - 1.47 TOTAL PHC

MW 1- 3.5 720 PPM Sample: 5318 1:10

Acquired: 11-NOV-90 2:57 Amount: 1.000

Channel: detector 1

Method: C:\MAX\DATA3\TEH1111

Inj Vol: 1.00

Filename: T1111-7 Operator:

 $_{\rm M}$  10<sup>-2</sup> uclts

- 1.47 TOTAL PHC

Sample: 5320

Channel: detector 1

Acquired: 11-NOV-90 3:47 Method: C:\MAX\DATA3\TEN1111 Amount: 1.000 Inj Vol: 1.00

 $\times$  10<sup>-2</sup> volte

\_ 1.47 TOTAL PUC

Filename: Tlll1-8
Operator:

Sample: 5321 1:10
Acquired: 11-NOV-90 7:09
Amount: 1.000

Channel: detector !
Method: C:\MAX\DATA3\TEH1111
Inj Vol: 1.00

Filename: T1111-12 Operator:

uelts

1.47 TOTAL PHC

8.28

MWZ-13.5

Sample: 5322 1:10 Acquired: 11-NOV-90 7:59 Amount: 1.000

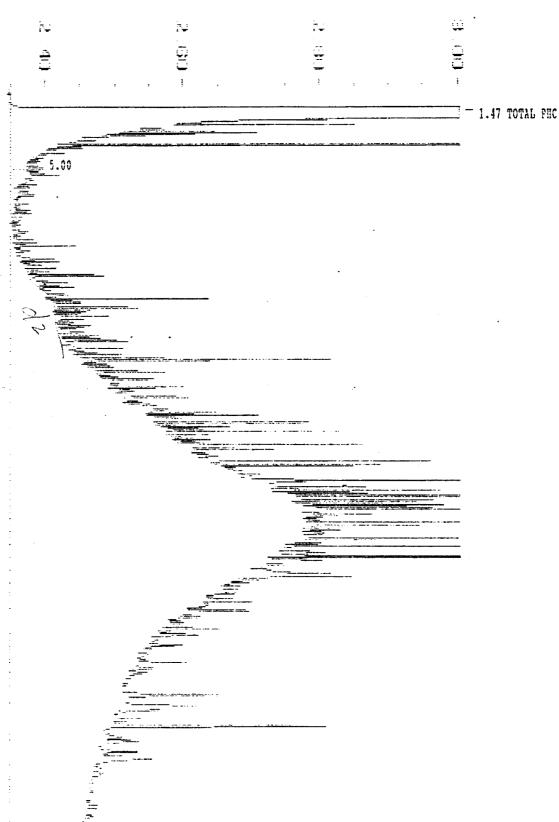
Channel: detector 1

Pilename: T1111-13

Method: C:\MAX\DATA3\TEU1111 Inj Vol: 1.00

Operator:

 $\times$  10<sup>-2</sup> volts

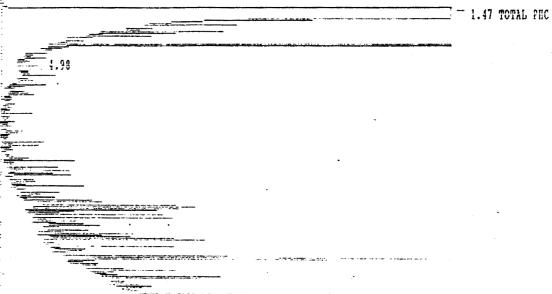


Sample: 5323 1:10 Sample: Acquired: 11-NOV-90 Amount: 1.000

Channel: detector 1

Method: C:\MAX\DATA3\TEH1111 Inj Vol: 1.00





Milenane: T1111-14

Pilename: T1111-18

| Sample: 5324 1:10 | Channel: detector 1 |
| Acquired: 11-NOV-90 | 12:11 | Method: C:\MAX\DATA3\TEW1111 |
| Amount: 1.000 | Inj Vol: 1.00

Operator:

$$\times$$
 10<sup>-2</sup> velts

1.47 TOTAL PHC

Sample: 5325 1:10

Amount: 1.000

Channel: detector 1

Acquired: 11-NCV-90 13:01 Method: C:\MAX\DATA3\TEH1111

Inj Vol: 1.00

uclts

- 1.47 TOTAL PHC

- Filename: T1111-19

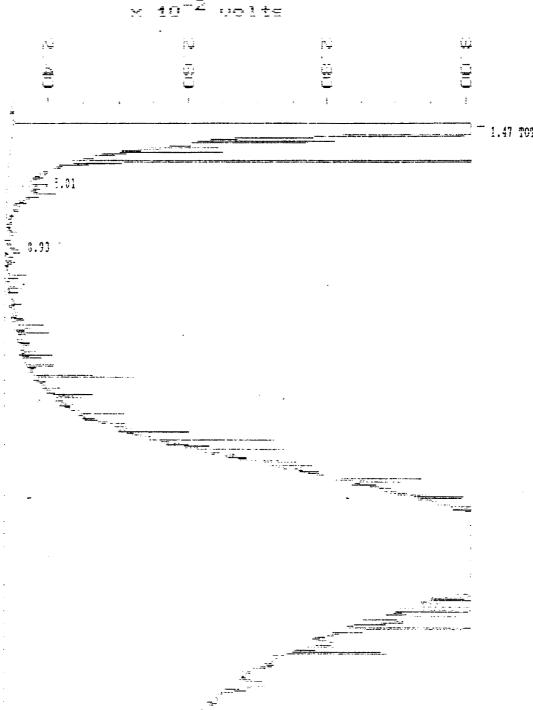
Sample: 5358 1:10 Acquired: 12-NOV-90 Amount: 1.000

Channel: detector 1

2:24

Method: C:\MAX\DATA3\TEH1111 Inj Vol: 1.00

Pilename: Tlll1-32



Sample: 5355 1:100

Amount: 1.000

Channel: detector 1

Acquired: 12-NOV-90 8:27 Method: C:\MAX\DATA3\TED1111

Inj Vol: 1.00

uolts

\_ 1.47 TOTAL PRO

Pilename: T1111-38

Sample: 5357

Channel: detector 1

Acquired: 12-NOV-90 1:33 Method: C:\MAX\DATA3\TEB1111 Amount: 1.000 Inj Vol: 1.00

uglts

1.46 TOTAL PHC

- 4.99

Filename: Tlll1-31 Operator:

Bilenene: T1111-25 Acample: \$1470v-90 20:22 Chauned: detackop html:// -10-2 uolts 1.40 TOTAL PHC 56-1 3.5

=

Sample: 5349 Channel: detector 1 Pilename: Till1-33 Acquired: 12-NOV-90 3:14 Kethod: C:\MAX\DATA3\TEU1111 Operator:
Amount: 1.000 Inj Vol: 1.00

volts 1.47 TOTAL PRO

19 1 1/2 PM

Filename: T1111-34 Operator: Sample: 5350 Acquired: 12-NOV-90 Amount: 1.000 Channel: detector 1 Method: C:\MAX\DATA3\TEH1111 Inj Vol: 1.00 4:04 uolts \_ 1.45 TOTAL PIIC

2.5 - 285

Sample: 5352 1:10

Channel: detector 1:

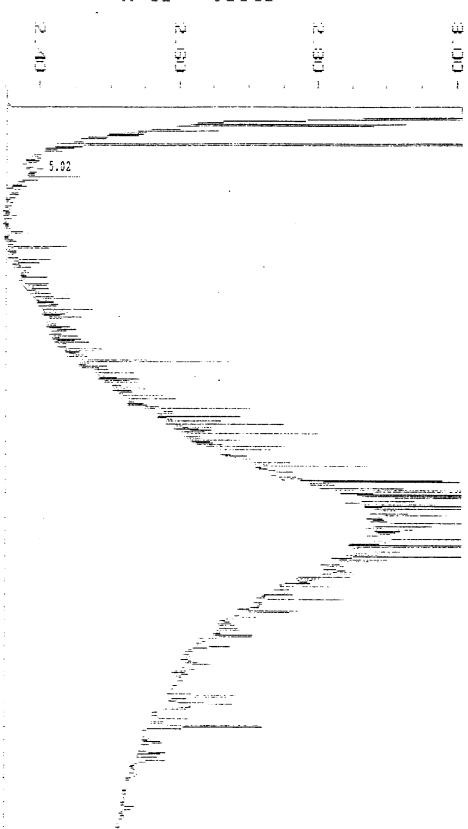
Acquired: 12-MOV-90 Amount: 1.000

4:55 Method: C:\MAX\DATA3\TEU1111
Inj Vol: 1.00

Filename: T1111-35 Operator:

1.47 TOTAL PHC

velts



Sample: 5353 1:10 Acquired: 12-NOV-90 Amount: 1.000

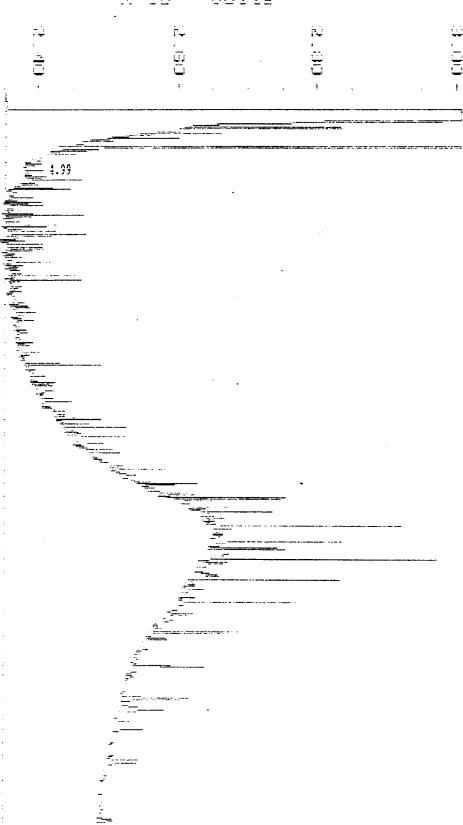
5:45

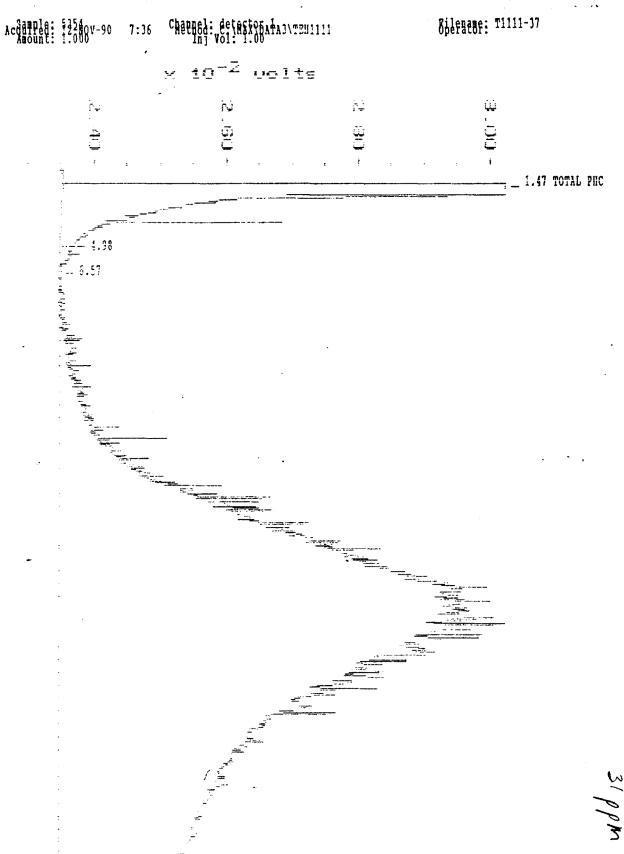
Channel: detector 1
5:45 Method: C:\MAX\DATAJ\TEN1111
Inj Vol: 1.00

Pilename: Till1-36 Operator:

1.47 TOTAL PHC

volts





11

Serie fine p. b.s.

SB-3 11.5

SITE ASSESSMENT FOR USTS 7100 2nd AVENUE SW SEATTLE, WASHINGTON

For

ALASKA MARINE LINES JOB NO. 21048-001-005 March 25, 1991



March 8, 1991

Mr. Bill Troy Alaska Marine Lines 7100 2nd Avenue SW, Seattle, Washington 98106

Site Assessment for UST's 7100 2nd Avenue SW Seattle, Washington

Dear Mr. Troy:

This report documents the permanent closure of two underground storage tanks (UST's) located at the above referenced site. Figure 1 is a site location map.

#### **BACKGROUND**

Two UST's of unknown age were located in a single excavation zone at the project site: one 10,000-gallon diesel UST and one 10,000-gallon gasoline UST. Both of these tanks were reported to have failed integrity tests that were conducted in April 1990 [1]. The results of a soil vapor survey conducted by Dames & Moore in September 1990 [2] suggested that leakage of petroleum products may have occurred from the UST's and/or associated piping; however, the extent of potentially contaminated soil and/or ground water was not evaluated.

A soil and ground water assessment was performed between October and December 1990 by Dames & Moore. The results of that work [3] identified only a limited amount of petroleum hydrocarbons in the subsurface that is directly associated with the two UST's. Figure 2 illustrates the locations of monitoring wells that were installed as part of that assessment.

It is the intent of AML to bring the UST's and their site into compliance with existing regulatory requirements for UST's. AML has removed the UST's and plans to remediate any soil or ground water that pose unacceptable risk to human health or the environment.

#### **PURPOSE**

The purpose of this assessment was to document UST closure and to evaluate the potential presence of fuel constituents in soil and ground water during the removal of the UST's. This

assessment is required under federal and state regulations. The general procedures for the site assessment are outlined in the following documents:

Code of Federal Regulations, "Technical Standards and Corrective Action Requirements For Owners and Operators of Underground Storage Tanks," 40 CFR, Subpart G, Section 280.72.

Washington Administrative Code, "Proposed Underground Storage Tank Regulations," dated August 1, 1990, WAC 173-360-390.

#### SCOPE OF WORK

The principal tasks completed by Dames & Moore during the assessment are listed below:

- 1. Observed the excavation of a 10,000-gallon diesel UST and a 10,000-gallon gasoline UST, hereinafter referred to as Tanks 1 & 2, respectively. The two UST's were located in a single excavation zone south of the refrigeration (refer) shop (Figure 2).
- 2. Submitted one soil sample, (SS-1) collected from the bottom of the excavation zone for laboratory analysis of total petroleum hydrocarbons (TPH).

### TANK CLOSURE ACTIVITIES

On January 24, 1991, Dames & Moore oversaw the removal of two UST's by B & C Construction (B & C). B & C began closure activities by disassembling the pump dispensers and demolishing the asphalt and concrete paving covering the tops of Tanks 1 & 2 with a hydrohammer. Following the removal of the paving with a trackhoe, the asphalt and concrete was loaded into a dumptruck and removed from site. The paving is reported to have been disposed of at Coal Creek Landfill. Once the paving was removed, Northwest Envirofield Services (NWES) pumped and rinsed the remaining product from the tanks. The pump and rinse certificate is provided as Attachment A. Soil was then excavated and the tops of Tanks 1 & 2 were exposed. The tanks were approximately four feet below top of asphalt (TOA) and the spacing between the tanks was approximately three feet. All soil removed from the tank

excavation zone was stored on asphalt paving surrounding the perimeter of the excavation zone.

On January 25, 1991, B & C inerted Tanks 1 & 2 with CO2 (dry ice). Lieutenant VanTrojen, with the Seattle Fire Department, witnessed the inertion. After receiving approval from the Fire Marshall, the tanks were removed and a visual inspection of the tanks revealed minor pitting and corrosion, no cracks or holes were observed. B & C Construction transported the tanks by flatbed to their facilities. The Tank Disposal Receipt is provided as Attachment B. After the removal of the tanks, excavation dimensions were approximately twenty feet wide by thirty-five feet long and approximately fifteen feet deep.

One soil sample (SS-1) was collected from the bottom of the excavation zone and was submitted for laboratory analysis of total petroleum hydrocarbons (TPH) by Modified EPA Method 8015. All excavated soil was returned to the excavation and compacted. Filter fabric was placed over the backfill and approximately seven vertical feet (195 cubic yards) of crushed rock was placed on top of the filter fabric. The excavation zone is to be resurfaced at a later time.

#### SOIL AND GROUND WATER ASSESSMENT

Figure 3 illustrates the subsurface conditions near the UST excavation zone. In the tank excavation zone, the backfill material consisted of fine to medium sand. Around the perimeter of the excavation zone, the soil lithology consisted of an upper three feet of fine to medium sand underlain by approximately two feet of silty sandy clay. Fine sand underlaid the layer of silty sand. Ground water was not encountered during excavation activities.

Excavated soil was visually stained from light grey to black and emitted strong petroleum odors. A petroleum sheen was present on the soil within the excavation zone at a depth of approximately fourteen feet.

The analytical report for the soil sample is included as Attachment C. The results indicate that the soil in the excavation zone area does not exceed the proposed cleanup levels for petroleum fuel constituents contained in the Model Toxics Control Act Amendments dated February 28, 1991 (MTCA). Additional soil samples were not collected at the time of

excavation due to the extensive soil and ground water sampling which was performed prior to the removal of the two UST's [3].

### SUMMARY AND RECOMMENDATIONS

A 10,000-gallon diesel UST and a 10,000-gallon gasoline UST have been removed from the AML site along with piping and ancillary equipment. Ground-water was not encountered during the excavation activities. The excavation has been backfilled and compacted. Analytical results indicate that the TPH levels in soil do not exceed the newly established MTCA cleanup levels for TPH. It should be noted that federal regulations require the site owner and/or operator to retain this report and that it should be available for review for a minimum of three years.

### CONCLUDING REMARKS

Dames & Moore has performed this work, made the findings, and proposed the recommendations described in this report in accordance with generally accepted environmental science practices in effect at the time the work was performed. Opinions and recommendations provided herein apply to site conditions existing at the time of our assessment and those conditions which we have been able to reasonably foresee. Opinions and recommendations provided do not necessarily apply to site changes of which this office is not aware and has not had the opportunity to evaluate. It must also be understood that changing circumstances in the environment and in the use of the property can alter the validity of conclusions and information contained in this report.

It is a pleasure to continue our services for Alaska Marine Lines. If you have any questions concerning this project, or if we can be of further assistance, please do not hesitate to call.

Sincerely,

Dames & Moore

Mark A. Chandler
Project Geologist

Wach a. Chardler

Susan C. Kent Project Manager

### Attachments

Figure 1
Figure 2
Figure 3
Pump and Rinse Certificate
Certificate of Tank Disposal
Analytical Results

### REFERENCES

- [1] B & C Equipment Company, April 26, 1990, Data Charts for Tank System Tightness Tests.
- [2] Dames & Moore, September 25, 1990, Report of Soil Vapor Survey, 7100 Second Avenue, Seattle, Washington.
- [3] Dames & Moore, In Progress, Soil and Ground Water Assessment, 7100 Second Avenue, Seattle, Washington.

### ATTACHMENT A

### PUMP AND RINSE CERTIFICATE



Underground Tank Division 762-1190

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PUMP AND RINSE CERTIFICATION	
.32	1-2-104-8
DATE: / - 21/- 9/	
TO WHOM IT MAY CONCERN	
	•
This letter is to certify that tank(s), size(s)	
210000 905	المنافض مشفوها ومهالا ووريستسلام مهجوري
2) 10,000 Diesel	•
	, no service of the s
have been pumped and rinsed for removal.	Tarty deficiency of the second
Work was performed at:	
7100 2Nd SW	
T -11	
- 15 Entile WA	The transmission medical and the second bud.
For:	
Lynden Inc.	<u></u>
Please note that this letter does not certify that the above tank(s) have been clean that it (they) should be considered gas-free	ed for disposal cr
Sincerely, 30 1048	
Northwest EnviroService, Inc.	
Doll	

### ATTACHMENT B

### CERTIFICATE OF TANK DISPOSAL



### B & C EQUIPMENT CO. SERVICE STATION & RELATED EQUIPMENT—SALES & SERVICE

19009 16TH AVE., S. . SEATTLE, WA 98188 . (206) 433-1015 ...

### CERTIFICATION OF TANK DISPOSAL

DATE: 2-5	-91	
LOCATION FROM WH	ICH REMOVED: Lynde	N # 1301
	d AVI S.W. SenTILC,	ut
QUANTITY	SIZE	LAST KNOWN PRODUCT
	10,000 GA1	GAS POR
TRANSPORT DRIVER	: John P. Cla	AP.K
	YARD: Scattle Scor	· ·
RECEIVED BY: (	JOSEAN BALLES	10h



### **B & C EQUIPMENT CO**

SERVICE STATION & RELATED EQUIPMENT - SALES & SERVICE

**1** 

19009 16TH AVE. S. SEATTLE, WA 96188 (206) 433-1015 FAX (206) 248-2531

### CERTIFICATION OF TANK DISPOSAL

DATE: 2/6/9/	<u>/</u>	
LOCATION FROM WHICH RE	MOVED: #/301	lynden
QUANTITY	SIZE	LAST KNOWN PRODUCT
	10,000 gg/	Diesel
	-	
•		
TRANSPORT DRIVER:	John (lark	
RECEIVING SCRAP YARD:	Ialman 1.	Boystul-Kent
RECEIVED BY:	Priam	
	1 Weres	Lineater

### ATTACHMENT C

### ANALYTICAL RESULTS



Alden Analytical Laboratories, Inc.

February 8, 1991

Dames & Moore Attn: Sue Kent 500 Market Place Tower 2025 1st Avenue Seattle, WA 98121

INRE: ALDEN PROJECT NUMBER 9101018/1

Dear Sue:

Enclosed are the analytical results for the soil samples submitted to Alden Labs January 28, 1991. The samples were analyzed for TEPH using Method 8015-Modified, Pentachlorophenol using Method 8270 and Total Arsenic. The inorganic analysis was performed by Sound Analytical Labs. A hard copy or thier report is included.

It is Alden's policy to dispose of samples two weeks after the report date, unless otherwise noted. If you have any questions please feel free to call me.

Sincerely,

John M. Buerger Laboratory Manager

**Enclosures** 

1001 SW Klickitat Way Seattle, WA 98134 Telephone (206) 623-3660 Facsimile (206) 624-8778



### REPORT OF ANALYTICAL RESULTS

Client: Dames & Moore

Client Sample Number: See below Date of Sample Receipt: 1/28/91

Matrix: Soil

Alden Job Number: 9101018/1

Alden Sample Number: See below Analysis Method: 8015-Modified

Reporting Units: mg/kg

Client <u>Sample ID</u>	Alden Sample Number	Extraction Date	Analysis Date	Total Extractable Hydrocarbons
NA	Blank	1/30/91	2/7/91	< 2.0
SS-1	6388	1/30/91	2/7/91	95
SS-1	6388RE	2/14/91	2/20/91	120

Note: Results are reported to two significant figures.



DATE 1/20/41 PAGE (\_ OF\_

Chain of Custody LABORATORY NUMBER:\_\_\_\_ 560 Naches Avenue SW, Suite 101 Renton, WA 98055 (206)228-8335 PROJECT MANAGER: SUE **ANALYSIS REQUEST** COMPANY: DAMES & MOORE Phosphate Pesticides TCLP ONLY NUMBER OF CONTAINERS EP TOX Metals (8) EP EXT ADDRESS: 2025 1 1 AVE WDOE PAHVHH (WAC 173) Pesticides & PCB's Aromatic Volatiles Seattle, WA 8150 Herbicides (2) GCMS BNA SAMPLED BY: M. Chandle PHONE: 728-0744 HPLC PNA PCB's ONLY SAMPLE DISPOSAL INSTRUCTIONS 418.1 (TPH) 9 9 8 9020 Metals (8) ATI Disposal @ \$5.00 each ☐ Return 8140 8010 8020 8015 8310 Š MATRIX LAB ID SAMPLE ID DATE TIME 55-1 1-25-91 PM 50:4 RELINQUISHED BY: 1. RELINQUISHED BY: 2. RELINQUISHED BY: SAMPLE RECEIPT PROJECT INFORMATION Signature: Time: Signature: Time: Signature: Time: PROJECT NUMBER: 2/0/8-00/ TOTAL NUMBER OF CONTAINERS Yack Chang 1:00 PROJECT NAME: A ML - ShipyALD COC SEALS/INTACT? Y/N/NA Printed Name: Date: Printed Name Date: Printed Name: Date PURCHASE ORDER NUMBER: RECEIVED GOOD COND/COLD B. Graham 1/20/41 NO 🗆 ONGOING PROJECT? YES X RECEIVED VIA: Company: / Company: Company: **PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS** RECEIVED BY: RECEIVED BY: RECEIVED BY: (LAB) 3. TAT: (NORMAL) X 2WKS ☐ 24HR (HUSH) 72 HRS 71 WK 48 HRS Signature: Time: Signature: Time: Signature: Time: GREATER THAN 24 HR. NOTICE? YES 🗖 ио П (LAB USE ONLY) SPECIAL INSTRUCTIONS: Printed Name: Date: Printed Name: Date: Printed Name: Date: Analytical Technologies, Inc. Company: Company:



### **UNDERGROUND STORAGE TANK**

### Site Check/Site Assessment Checklist

The purpose of this form is to certify the proper investigation of an UST site for the presence of a release. These activities shall be conducted in accordance with Chapter 173.360 WAC. A description of the various situations requiring a site check or site assessment is provided in the guidance document for UST site checks and site assessments.

This Site Check/Site Assessment Checklist shall be completed and signed by a person registered with the Department of Ecology to perform site assessments.

Two copies of the results of the site check or site assessment should be included with this checklist according to the reporting requirements in the guidance document for UST site checks and site assessments.

For further information about completing this form, please contact the Department of Ecology UST Program.

The completed checklist should be mailed to the following address:

Underground Storage Tank Section Department of Ecology Mail Stop PV-11 Olympia, WA 98504-8711

UST Owner/Operator:	Alaska Marine Li	nes	and the state of t							
Owners Address:	5615 West Marginal Way SW									
	Street		P.O. Box							
	Seattle City	Washington	98106							
	(206 ) 763-4244	State	ZiP-Code							
Telephone:	(200 ) 103-4244		•							
Site ID Number (on invol	ice or available from Ecology	y if tank is registered):N/A								
Site/Business Name:	Alaska Marine Lin	es (Shipyard)								
Site Address:	7100 2nd Avenue St	w	King							
	Street	9.7	County							
	Seattle	Washington	98106							
	City	State	ZiP-Code							
2. SITE CHECK/SITE	E ASSESSMENT CONDU	JCTED BY:								
Registered Person:	Mark A. Chandler	r ·								
Address:	2025 1st Avenue	Suite 500	•							
	Street	34100 300	P.O. Box							
	Seattle	Washington State	98121							
	City	State	ZIP-Code							
Telephone:	(206) 728-0744									



### UNDERGROUND STORAGE TANK Permanent Closure/Change-In-Service Checklist

The purpose of this form is to certify the proper closure/change-in-service of underground storage tank (UST) systems. These activities must be conducted in accordance with Chapter 173.360 WAC. Washington State UST rules require the tank owner or operator to notify Ecology in writing 30 days prior to closure or change-in-service of tanks. This must be done by completing the 30 Day Notice form (ECY 010-155).

This Permanent Closure Checklist shall be completed and signed by a Licensed Decommissioning Supervisor. The supervisor shall be on site when all tank permanent closure/change-in-service activities are being conducted. The firm which employs the licensed supervisor shall also be licensed by the Washington State Department of Ecology as a Service Provider. If any of the activities listed below have been supervised by a different licensed supervisor, a separate checklist must be filled out and signed by the licensed supervisor performing those activities.

For further information about completing this form, please contact the Department of Ecology UST Program.

A separate checklist must be completed for each UST system (tank and associated piping), except that UST systems at one site may be reported together by completing page 2 of this form separately for each system. The completed checklist should be mailed to the following address within 30 days of the completion of the closure or change-in-service.

Underground Storage Tank Section Department of Ecology Mail Stop PV-11 Olympia, WA 98504-8711

1. UST SYSTEM OW	NER AND LOCATION		
Site Owner/Operator:	Alaska Mariñé Lines	6	,
Owners Address:	5615 West Marginal	P.O. Box	
	Seattle	Washington	98106
Telephone:	City ( 205 ) 763–4244	State	Z)P-Code
	ce or available from Ecology if tar		
Site/Business Name:	Alaska Marine Lines	(Shipyard)	· ·
Site Address:	7100 2nd Avenue SW		
	Street		County
	Seattle City	Washington State	98106 ZIP-Code
2. TANK PERMANEN	IT CLOSURE/CHANGE-IN-S	ERVICE PERFORMED BY	
Firm:	B & C Construction		License Number: BCEQU**243B3
Address:	<b>20320 80th Avenue S</b>	S	
	Street Kent	Washington	P.O. Box 98032
Telephone:	сіў ( 206 ) 872–8890	State	ŽIP-Codė
Licensed Supervisor:	Mark a. Chand	lhe	Decommissioning License Number: W000494

This page must be completed separately for each tank permanently closed (decommissioned) or change-in-service at the site. For additional tanks you may photocopy this form prior to completing.

3. TANK CLOSURE/CHANGE-IN-SERVICE INFORMATION	· Fishing	<b>A</b>
Tank ID Number (as registered with Ecology): N/A     2. Year installed:unkner.	own	
3. Tank capacity in gallons: 10,000 4. Date of last use: 1-10	-91	
5. Last substance stored:gasoline 6. Date of closure/change-in-s	ervice: 1.	-24-91
7. Type of closure: Closure with Tank Removal X In-place Closure Ch	ange-in-Servic	се
8. If in-place closure is used, the tank has been filled with the following substance: N/A		
9. If change-in-service, indicate new substance stored in tank:  N/A		
10. Local permit(s) (if any) obtained from: Seattle Fire Department		
Always contact local authorities regarding permit requirements.		
11. Has a site assessment been completed? Yes X No		
Unless an external release detection system is operating at the time of closure or change in service, and a report is 173-360-390, a site assessment must be conducted. This site assessment must be conducted by a person register Ecology to perform site assessments. Results of the site assessment must be included with the Site Assessment Cl	ed with the Depa	artment of
4. CHECKLIST	Ten Shahir See	
Each item of the following checklist shall be initialed by the licensed supervisor whose signature	· · · · · · · · · · · · · · · · · · ·	ow. No NA*
Has all liquid been removed from product liftés?	MC	
2. Has all product piping been capped or removed?	mc	
3. Have all non-product lines been capped or removed?	MC	
4. Have all liquid and accumulated studges been removed from the tank?	MC	
5. Has the tank been properly purged or inerted?	MC	
6. Have the drop tube, fill pipe, gauge pipe, pumps and other tank fixtures been removed?	MC	
7. Have all tank openings been plugged or capped? NOTE: One plug should have 1/8 inch vent hote.	MC	
8. Have all sludges removed from the tank been designated and disposed of in accordance with the state of Washington's dangerous waste regulations (Chapter 173-303 WAC)?		
If removed, was tank properly labeled and disposed of in accordance with all applicable local, state and federal regulations?	MC	
*Item not applicable  I hereby certify that I have been the licensed supervisor present on site during the above listed permanent the best of my knowledge they have been conducted in compliance with all applicable state and federal leprocedures pertaining to underground storage tanks.	t closure activ	ities and to ns and
Persons submitting false information are subject to penalties under Chapter 173.360 WAC.  3-5-9/  D & M Wall Of Chaptella.		
Date Signature of Lice/sed Supervisor		
5. ADDITIONAL REQUIRED SIGNATURES		
3/7/9/ Bea Man /		
Onte Signature of Licensed Service Provider (Furn) Owner or Authorized Representative	-	
Date Signature of Tank Owner or Authorized Representative		

FIRST QUARTERLY SAMPLING EVENT 7100 SECOND AVENUE SEPTEMBER, 1991 SEATTLE, WASHINGTON

For

ALASKA MARINE LINE JOB NO. 21048-006-005 November 18, 1991



November 18, 1991

Mr. Bill Troy, President Alaska Marine Lines 7100 Second Avenue Seattle, Washington

> First Quarterly Sampling Event September, 1991 7100 Second Avenue Seattle, Washington

Dear Mr. Troy:

This letter report summarizes the findings and conclusions for the first quarterly sampling event at the 7100 Second Avenue site.

### MONITORING WELL SAMPLE COLLECTION

Dames & Moore sampled the monitoring wells on September 5, 1991. Prior to sampling, all wells were purged using a decontaminated Teflon bailer. The bailer was lowered using a dedicated rope into the monitoring well. Decontamination procedures entailed scrubbing the bailer with alconox, an industrial soap, and thoroughly rinsing with deionized water. Ground-water samples were retrieved by bailer. Temperature, pH, and specific conductivity readings were monitored during the well purging. These parameters indicate whether ground-water conditions have stabilized and whether samples are fresh. Parameters associated with purging the monitoring wells are listed in Table 1.

Monitoring wells MW-5 and MW-6 were not sampled on September 5, 1991 because the wells were covered with asphalt pavement. The wells have since been uncovered, therefore, MW-5 and MW-6 will be sampled during the second quarterly sampling round.

### **WATER LEVELS**

Water level measurements collected during sampling and during previous sampling events are tabulated on Table 2. The water level data is contoured on Figure 1.

Alaska Marine Lines November 18, 1991 Page 2

### LABORATORY RESULTS

The ground-water samples were analyzed for total petroleum hydrocarbons (TPH; EPA modified method 8015), and benzene, toluene, ethylbenzene, and xylene (BTEX; EPA modified 8020) by Analytical Resources, Incorporated located in Seattle, Washington. Table 3 presents the analytical results from this sampling event and the analytical results from previous sampling events.

### **GROUND-WATER QUALITY ASSURANCE/QUALITY CONTROL SAMPLES**

Results of ground-water QA/QC analysis are reported in Table 4. Duplicate values for toluene are reproducible within 46 percent. Benzene, in a duplicate sample from MW-7, was not detected above the detection limit. This result indicates that initial analytical results are subject to change upon re-analysis. Duplicate samples analyzed for ethylbenzene and xylene were not detected above the laboratory detection limit. The results from the rinsate sampling show no detection of BTEX compounds.

We will notify your facilities of our expected second quarterly sampling dates one week in advance. Please call if you have any questions.

Sincerely,

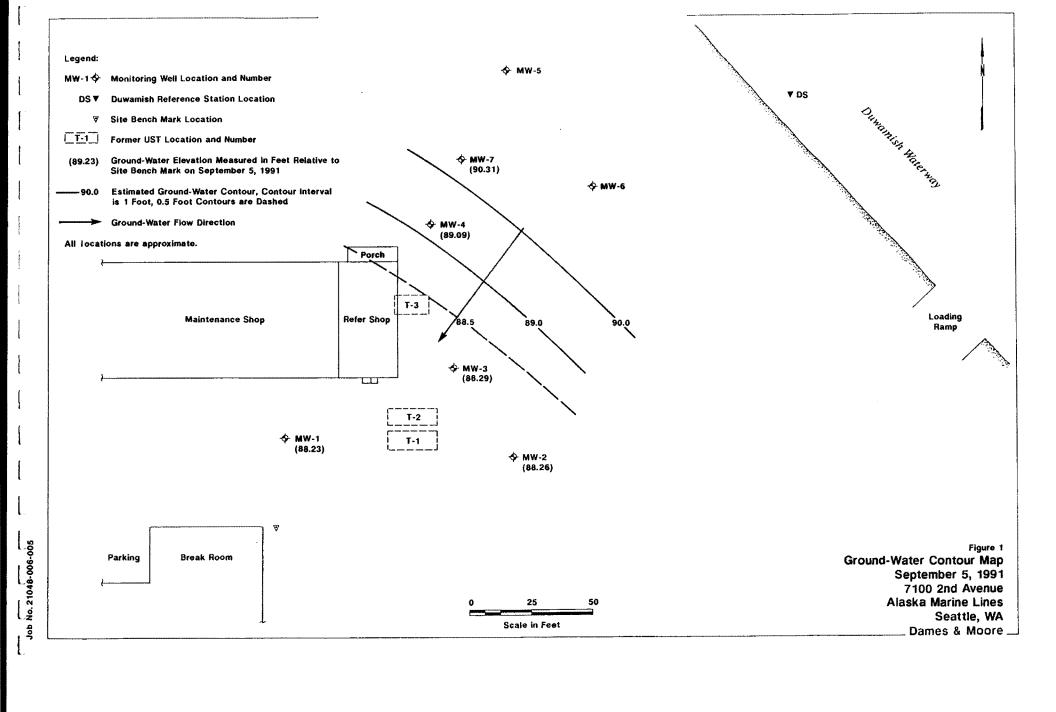
Ingrid M. Williams
Staff Hydrogeologist

ngrid H. William.

Mark P. Molinari for Susan C. Kent Project Manager

cc: Mr. Bob Strong

005\LETTERS\7100~1Q.LWP



## TABLE 1 GROUND-WATER SAMPLING DATA 7100 2nd Avenue Alaska Marine Lines

WELL NO.	DATE	TIME	pH (-log H†)	T (°C)	SC (µS)	Well Vol (gal)	Purge Vol (gal)	Method	Remarks
MW1	9/5/91	16:00	7.97	17.9	3090	5.1	15.5	bail	yellow, brown color to H <sub>2</sub> 0
MW2	9/5/91	11:50	7.49	17.5	1591	5.1	18	bail	not noted
MW3	9/5/91	15:05	7.94	17.7	2070	5.2	18	bail	yellow, very silty
MW4	9/5/91	13:47	7.51	17.2	1647	6.0	18	bail	strong hydrocarbon odor, slightly silty
MW5	9/5/91			<b>~</b> -			***		not sampled
MW6	9/5/91								not sampled
MW7	9/5/91	16:47	7.30	18.0	1152	1.6	5	bail	sludge laden H <sub>2</sub> 0 fills space between monument and top of casing

005\MISC\LYNDEN.TBL

## TABLE 2 SUMMARY OF WATER LEVEL DATA 7100 Second Avenue Alaska Marine Lines

		NOVEN	И <b>BER</b> 1, 1990	JANUA	ARY 15, 1991	JANUA	ARY 25, 1991	SEPTEMBER 5, 1991		
WELL NO.	REFERENCE ELEVATION*2	DEPTH TO WATER	WATER LEVEL ELEVATION	DEPTH TO WATER	WATER LEVEL ELEVATION* 2	DEPTH TO WATER	WATER LEVEL ELEVATION*2	DEPTH TO WATER	WATER LEVEL ELEVATION* <sup>2</sup>	
MW-1	99.84	11.97	87.87	11.14	88.70	11.53	88.31	11.61	88.23	
MW-2	99.52	11.34	88.18	10.44	89.08	11.12	88.40	11.26	88.26	
MW-3	99.71	11.82	87.89	10.96	88.75	11.28	88.43	11.42	88.29	
MW-4	99.42	10.97	88.45	10.11	89.31	10.20	89.22	10.33	89.09	
MW-5	98.32	N/A	N/A	8.75	89.57	9.21	89.11	N/A*1	N/A*1	
MW-6	98.43	N/A	N/A	8.77	89.66	9.38	89.05	N/A*1	N/A*1	
MW-7	99.48	N/A	N/A	8.98	90.5	9.00	90.48	9.17	90.31	
PIER	101.37	N/A	N/A	13.43	87.94	12.12	89.25	N/A	N/A	

N/A Not Analyzed

005\MISC\LYNDEN.TBL

<sup>\*1</sup> Well covered with asphalt on 9/5/91

Water elevations are relative to the site bench mark, which is the yellow-painted obstruction post located west of the voltage transformer on the south side of the site. The site bench mark is assigned an arbitrary elevation of 100.00 feet.

## TABLE 3 SUMMARY OF GROUND-WATER ANALYTICAL DATA 7100 Second Avenue Alaska Marine Lines

		WELL NO.:	MV	V-1	MW-2			MW-3				
	SAI	MPLE DATE:	11/1/90	9/5/91	11/1/90	9/5/	9/5/91		11/1/90		9/5/91	
Analysis Units MTCA [1]												
ТРН	mg/L	1	0.59	<10.0	0.56	<10	.0	0.33		NA	<10.0	
BENZENE	μg/L	5	<1.0	<1.0	<1.0	88		<1.0		420	630*	
TOLUENE	μg/L	40	<1.0	<1.0	<1.0	<1.	0	<1.0		3.5	3.2	
ETHYLBENZENE	μg/L	30	<1.0	<1.0	<1.0	<1.	0	1.1		13	16	
XYLENES	μg/L	20	<1.0	<2.0	<1.0	<2.0		5.3		48.4	25	
		WELL NO.:		MW-4		MW-	·5	MW-	6	MW-	·7	
	SAI	WELL NO.:	11/1/90	MW-4 12/18/90	9/5/91	MW- 12/18/90	-5 9/5/ <b>9</b> 1	MW- 12/18/90	6 9/5/91	<b>MW</b> -12/18/90	-7 9/5/91	
Analysis	SAI Units		11/1/90		9/5/91				ľ			
Analysis TPH		MPLE DATE:	11/1/90		9/5/91 NA				ľ			
	Units	MPLE DATE:		12/18/90		12/18/90	9/5/91	12/18/90	9/5/91	12/18/90	9/5/91	
ТРН	Units mg/L	MPLE DATE: MTCA [1]	0.27	12/18/ <b>90</b> NA	NA	12/18/90 NA	9/5/91 NA	12/18/90 NA	9/5/91 NA	12/18/90 NA	9/5/91	
TPH BENZENE	Units mg/L μg/L	MPLE DATE: MTCA [1]  1  5	0.27 4200	12/18/ <b>90</b> NA  3600	NA 2000	12/18/90 NA <5.0	9/5/91 NA NA	12/18/90 NA <5.0	9/5/91 NA NA	12/18/90 NA <5.0	9/5/91 <10.0 3.4	

MTCA - The Model Toxics Control Act Cleanup Regulation, effective February 28, 1991

NA - Not analyzed

005\MISC\LYNDEN.TBL

<sup>&</sup>lt; - This parameter was not detected at a concentration above the detection level indicated in the table.

## TABLE 4 SUMMARY OF GROUND-WATER QA/QC ANALYTICAL DATA 7100 Second Avenue Alaska Marine Lines

DUPLICATE WELL	SAMPLING DATE	WELL NO.	ANALYSIS (µg/L)	SAMPLE VALUES	DUPLICATE VALUES
SAMPLES	9/5/91	MW-7	Benzene Toluene	3.4 79	<14 43
			Ethylbenzene Xylenes	<1.0 <2.0	<14 <28

RINSATE SAMPLES	SAMPLING DATE	WELL NO.	ANALYSIS (µg/L)	SAMPLE VALUES	DUPLICATE VALUES
	9/5/91	N/A	Benzene	<1.0	N/A
			Toluene Ethylbenzene	<1.0 <1.0	N/A N/A
			Xylenes	<2.0	N/A

N/A - Not applicable.

19 September 1991



DAMES & MOORE SEATTLE SEP 2 0 1991 ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sue Kent Dames & Moore 500 Market Place Tower 2025 First Avenue Seattle, WA 98121

RE: Client Project: 21048 006 5052 005;

ARI Job #8994

Dear Sue:

Please find enclosed the results for the above referenced project.

If you have any questions or require additional information, please feel free to call any time.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kate Stegemoeller Project Coordinator

Kate Stepensol

KAS/kp

**Enclosures** 

cc: ARI file #8994



### ORGANICS ANALYSIS DATA SHEET - Method 602/8020 BETX by GC-PID

Matrix: Water Level: Low QC Report No: 8994-Dames & Moore Project No: 21048 006 5052 005

Date Received: 9/5/91

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

# Data Release Authorized: Jam B. Islandia Report prepared: 9/18/91 - MAC:K kas

		Method	MW1-	MW1-	MW2-	MW3-
	Sample No.	Blank	90591	90591	90591	90591
	ARI ID	0909MB	8994A	8994Adup	8994B	8994C
	Date Analyzed	09/09/91	09/09/91	09/09/91	09/09/91	09/09/91
	Amt Analyzed	5.0 mls				
CAS Number	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2 Benzene		1.0 U	1.0 U	1.0 U	88	310 X
108-88-3 Toluene		1.0 U	1.0 U	1.0 U	1.0 U	3.2
100-41-4 Ethylbenzene		1.0 U	1.0 U	1.0 U	1.0 U	16
1330-20-7 Total Xylenes		2.0 U	2.0 U	2.0 U	2.0 U	25

**Surrogate Recoveries** 

Trifluorotoluene	97.6%	98.9%	94.6%	94.9%	93.8%
Bromobenzene	98.0%	102%	96.7%	94.7%	100%

			MW4-	MW7-	Trip
		Sample No.	90591	90591	Blank
		ARI ID	8994D	8994E	8994F
		Date Analyzed	09/09/91	09/09/91	09/10/91
		Amt Analyzed	5.0 mls	5.0 mls	5.0 mls
CAS Num	ber	Units	μg/L	μg/L	μg/L
71-43-2	Benzene		560 X	3.4	1.0 U
108-88-3	Toluene		12	79	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		19	2.0 U	2.0 U

**Surrogate Recoveries** 

Trifluorotoluene	76.9%	92.6%	87.0%
Bromobenzene	91.8%	94.8%	89.0%

### **Data Reporting Qualifiers**

В

Value If the result is a value greater than or equal to the detection limit, report the value.

This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.



### ORGANICS ANALYSIS DATA SHEET - Method 602/8020 BETX by GC-PID

Matrix: Water Level: Low

Data Release Authorized: //www.S.K.as Report prepared: 9/18/91 - MAC:K kas QC Report No: 8994-Dames & Moore Project No: 21048 006 5052 005

Date Received: 9/5/91

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

			Method	MW3-	MW4-	MW7-
		Sample No.	Blank	90591 di	90591 dl	90591 re
		ARI ID	0911MB	8994CdI	8994Ddl	8994Ere
		Date Analyzed	09/11/91	09/12/91	09/12/91	09/12/91
		Amt Analyzed	5.0 mls	0.1 mls	0.1 mls	5.0 mls
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	670	2000	2.0
108-88-3	Toluene		1.0 U	50 U	50 U	70
	Ethylbenzene		1.0 U	50 U	50 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	100 U	100 U	2.0 U

Surrogate Recoveries

ouriogaic recording				
Trifluorotoluene	102%	53.1%	107%	105%
Bromobenzene	102%	56.7%	95.0%	99.2%

			Method	MW3-
		Sample No.	Blank	90591 dl2
		ARI ID	0917MB	8994Cdl2
		Date Analyzed	09/17/91	09/17/91
		Amt Analyzed	5.0 mls	0.1 mls
CAS Num	ber	Units	μg/L	μg/L
71-43-2	Benzene		1.0 U	590
108-88-3	Toluene		1.0 U	50 U
	Ethylbenzene		1.0 U	50 U
1330-20-7	Total Xylenes		2.0 U	100 U

**Surrogate Recoveries** 

Trifluorotoluene	98.6%	95.0%
Bromobenzene	97.9%	94.8%

### **Data Reporting Qualifiers**

Value If the result is a value greater than or equal to the detection limit, report the value.

- B This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when result is less than specified detection limit.



### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

### TOTAL PETROLEUM HYDROCARBONS BY GC/FID Modified EPA Method 8015

Matrix: Waters

Project: 21048 006 5052 005

QC Report No: 8994-Dames & Moore

Data Release Authorized Collaboration VISR: 09/05/91

Report Prepared: 9/13/91 - MAC:K kas

Date Extracted:

09/10/91

Date Analyzed:

09/11/91

Surr. Recovery Client Sample ID TPH (ppm) Pattern ID Gas. Diesel Lab ID 8994 MB Method Blank 10 U 78.6% 95.1% 8994 A 10 U 122% 185% MW1-090591 -----8994 B MW2-090591 10 U 80.0% 98.8% -----8994 C MW3-090591 10 U 87.9% 110% 8994 D MW4-090591 10 U 94.7% 107% 8994 E MW7-090591 10 U 73.0% 107%

U Indicates compound was analyzed for but not detected at the given detection limit.

Gasoline surrogate: Bromobenzene Diesel surrogate: Me-arachidate



Project Number: _2	21048	00651	257 0	p5							Ana	lysis	Req	uest						
Project Manager: — Laboratory: — Turn around time: —	ART 2 W	iks.		ks /MS)	/olatiles	piles	Acids /MS)		matic 610/8310	8	8015 5, (as	的政			nt	s <sub>2</sub>			Comments/	ntainers
Sampler's Initials: - Sampler's Signature: -				Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Aromatic Volatiles 602/8020	Base/Neutral/Acids 625/8270 (GC/MS)	BTX 602/8015	Polycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8080	3				Priority Pollutant Metals (13)	EP TOX Metals (8)			Instructions	Number of Containers
Sample ID	Date		Matrix	Vol.	玉 28	\$8	Bas 625	TB CT	SŦ	% 8 %	Mod	2			A Prix	₩ €				호
MWI -090591	1/5/9	1/16/15	H20								×	×								3
MW 2-090571		1200					<u> </u>		<u> </u>		X	X								3
MW3- 090591		1520									X	Х							_	3
MW4-090591		1415									K	×								3
MW7-090591	T	1700	V								Х	Х								3
MW \$ 7-090591-D	9/5/0	1100	-11									# W	me IMW						no analytis	2
Trip Blank	94/9		13																	2
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Special Instructions/Co	mment	s:	***************************************	Relin	nquish	ed by:				<del></del>	Rece	ived t	y (lab)	):			(	S	ample Receip	ot
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					ie)_ <u>  2</u>	,03		_ (Dat	e) # ්		(Tim	e) <i>/_⊆</i>	10		_ (Dat	e <i>γ/_3</i> /	171	Lab r	number:	

A.R.I.# 8994

SECOND QUARTERLY SAMPLING EVENT JANUARY, 1992 7100 SECOND AVENUE

For

ALASKA MARINE LINES JOB NO. 21048-004-005 MARCH 20, 1992





500 MARKET PLACE TOWER, 2025 FIRST AVENUE, SEATTLE, WASHINGTON 98121 (206) 728-0744 FAX: (206) 448-7994

March 20, 1992

Alaska Marine Lines 7100 Second Avenue Seattle, Washington

Attn:

Mr. Bill Troy

President

Second Quarterly Sampling Event January, 1992 7100 Second Avenue Seattle, Washington

Dear Mr. Troy:

This letter report summarizes the findings and conclusions for the second quarterly sampling event at the 7100 Second Avenue site.

### Monitoring Well Sample Collection

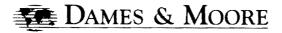
Dames & Moore sampled the monitoring wells on January 10, 1992. Prior to sampling, all wells were purged using a decontaminated Teflon bailer. The bailer was lowered using a dedicated rope into the monitoring well. Decontamination procedures entailed scrubbing the bailer with alconox, an industrial soap, and thoroughly rinsing with deionized water. Ground-water samples were retrieved by bailer. Temperature, pH, and specific conductivity readings were monitored during the well purging. These parameters indicate whether ground-water conditions have stabilized and whether samples are fresh. Parameters associated with purging the monitoring wells are listed in Table 1.

#### Water Levels

Water level measurements collected during sampling and during previous sampling events are tabulated on Table 2. The water level data is contoured on Figure 1.

### **Laboratory Results**

The ground-water samples were analyzed for total petroleum hydrocarbons (TPH; EPA modified method 8015), and benzene, toluene, ethylbenzene, and xylene (BTEX; EPA modified 8020) by



Alaska Marine Lines March 20, 1992 Page 2

Analytical Resources Incorporated located in Seattle, Washington. Table 3 presents the analytical results from this sampling event and the analytical results from previous sampling events.

### Ground-Water Quality Assurance/Quality Control Samples

Results of ground-water QA/QC analysis are reported in Table 4. Duplicate values for toluene are reproducible within 46 percent. Benzene, in a duplicate sample from MW-7, was not detected above the detection limit. This result indicates that initial analytical results are subject to change upon re-analysis. Duplicate samples analyzed for ethylbenzene and xylene were not detected above the laboratory detection limit. The results from the rinsate sampling show no detection of BTEX compounds.

We will notify your facilities of our expected second quarterly sampling dates one week in advance. Please call if you have any questions.

Sincerely,

DAMES & MOORE, INC.

Dagrid M. Williams/mpm

Susan C. Kent/mpm

Ingrid M. Williams Staff Hydrogeologist

Susan C. Kent Project Manager

005\LETTER5\/100-2QT.LWP

Job No. 21048-001-005

# TABLE 1 GROUND-WATER SAMPLING DATA SECOND QUARTERLY SAMPLING EVENT 7100 2nd Avenue Alaska Marine Lines

WELL NO.	DATE	TIME	pH (-log H <sup>+</sup> )	T (°C)	SC (µS)	Well Vol (gal)	Purge Vol (gal)	Method	Remarks
MW1	1/10/92	08:30	7.10	51.7	2920	5.3	15	BK Pump	yellowish brown color
MW2	1/10/92	08:15	6.76	56.2	1603	5.3	15	BK Pump	sulfur odor
MW3	1/10/92	08:50	6.83	51.7	1925	4.8	15	BK Pump	strong hydrocarbon odor
MW4	1/10/92	09:00	6.84	51.5	1598	5.9	12	BK Pump	strong hydrocarbon odor, grey color
MW5	1/10/92	11:00	7.07	51.6	1890	6.4	5	BK Pump	very silty, black color, no odor
MW6	1/10/92	10:05	6.70	54.1	4880	7.2	13	BK Pump	sulfur odor, black color, very silty
MW7	1/10/92	09:30	6.73	52.5	1633	6.5	12	BK Pump	lots of mud in well

# TABLE 2 SUMMARY OF WATER LEVEL DATA SECOND QUARTERLY SAMPLING EVENT 7100 Second Avenue Alaska Marine Lines

		JANUARY 15, 1991		JANU	ARY 25, 1991	SEPTEM	1BER 5, 1991	JANUARY 10, 1992	
WELL NO.	REFERENCE ELEVATION*2	DEPTH TO WATER	WATER LEVEL ELEVATION*2	DEPTH TO WATER	TO LEVEL		WATER LEVEL ELEVATION*2	DEPTH TO WATER	WATER LEVEL ELEVATION•2
MW-1	99.84	11.14	88.70	11.53	88.31	11.61	88.23	11.11	88.73
MW-2	99.52	10.44	89.08	11.12	88.40	11.26	88.26	10.70	88.82
MW-3	99.71	10.96	88.75	11.28	88.43	11.42	88.29	11.90	87.81
MW-4	99.42	10.11	89.31	10.20	89.22	10.33	89.09	10.05	88.92
MW-5	98.32	8.75	89.57	9.21	89.11	N/A*1	N/A*1	8.84	89.48
MW-6	98.43	8.77	89.66	9.38	89.05	N/A*1	N/A*1	7.50	90.93
MW-7	99.48	8.98	90.5	9.00	90.48	9.17	90.31	9.06	90.42
PIER	101.37	13.43	87.94	12.12	89.25	N/A	N/A	10.60	90.77

N/A Not Analyzed

\* Well covered with asphalt on 9/5/91

OOS\MISC\AML2Q.TBL

Water elevations are relative to the site bench mark, which is the yellow-painted obstruction post located west of the voltage transformer on the south side of the site. The site bench mark is assigned an arbitrary elevation of 100.00 feet.

Table 3
Summary of Ground-Water Analytical Data
7100 Second Avenue
Alaska Marine Lines

	Analysis						
Well	Sampling	TPH	Benzene	Toluene	Ethylbenzene	Xylenes	
Number	Date	mg/l	ug/l	ug/t	ug/l	ug/l	
MW-1	11/1/90	0.59	<1.0	<1.0	<1.0	<1.0	
	12/18/90	NA	NA	NA	NA	NA	
	9/5/91	<10.0	<1.0	<1.0	<1.0	<2.0	
	1/10/92	<2.0	<1.0	<1.0	<1.0	<2.0	
MW-2	11/1/90	0.56	<1.0	<1.0	<1.0	<1.0	
	12/18/90	NA	NA	NA	NA	NA	
	9/5/91	<10.0	88	<1.0	<1.0	<2.0	
	1/10/92	<2,0	110	<1.0	<1.0	<2.0	
MW-3	11/1/90	0.33	<1.0	<1.0	1.1	5.3	
	12/18/90	NA	420	3.5	13	48.4	
	9/5/91	<10.0	630*	3.2	16	25	
	1/10/92	<2.0	500*	3.8	14	17	
MW-4	11/1/90	0.027	4200	8.3	2.1	4.2	
	12/18/90	NA	3600	<50	<50	63	
	9/5/91	NA	2000	12	<1.0	19	
	1/10/92	<2.0	2700*	11	4.1	17	
MW-5	11/1/90	NA	NA	NA	NA	NA	
	12/18/90	NA	<5.0	<5.0	<5.0	<5.0	
	9/5/91	NA	NA	NA	NA	NA	
	1/10/92	<2.0	<1.0	<1.0	<1.0	<2.0	
MW-6	11/1/90	NA	NA	NA	NA	NA	
	12/18/90	NA	<5.0	<5.0	<5.0	<5.0	
	9/5/91	NA	NA	NA	NA	NA	
	1/10/92	<2.0	<1.0	<1.0	<1.0	<2.0	
	4411-75			112		1	
MW-7	11/1/90	NA	NA	NA	NA 50	NA	
	12/18/90	NA	<5.0	<5.0	<5.0	<5.0	
	9/5/91	<10.0	3.4	79	<1.0	<2.0	
	1/10/92	<2.0	1.7	4.2	<1.0	<2.0	
MTCA [1]		1	5	40	30	20	

<sup>[1] -</sup> MTCA- The Model Toxics Control Act Cleanup Regulation, Effective February 28, 1991. Numbers in bold indicate a concentration at or above the MTCA cleanup levels.

<sup>&</sup>lt; - This parameter was not detected at a concentration above the detection level indicated in the table. NA - Not Analyzed

<sup>\* -</sup> Indicates the initial analysis of the sample was above the linear range of the analytical instrument. The value shown is the concentration obtained following the required dilution.

## TABLE 4 SUMMARY OF GROUND-WATER QA/QC ANALYTICAL DATA 7100 Second Avenue Alaska Marine Lines

DUPLICATE WELL	SAMPLING DATE	WELL NO.	ANALYSIS (µg/L)	SAMPLE VALUES	DUPLICATE VALUES
SAMPLES	1/9/92	MW-4	Benzene	210	205*
			Toluene Ethylbenzene	< 1.0 1.0	1.0U 0.9 <b>J</b>
			Xylenes	3.1	3.5

RINSATE SAMPLES	SAMPLING DATE	WELL NO.	ANALYSIS (µg/L)	SAMPLE VALUES	DUPLICATE VALUES
	1/9/92	N/A	Benzene	N/A	< 1.0
	. ,		Toluene	N/A	< 1.0
			Ethylbenzene	N/A	< 1.0
			Xylenes	N/A	< 2.0

TRIP BLANK	SAMPLING DATE	WELL NO.	ANALYSIS (µg/L)	SAMPLE VALUES	DUPLICATE VALUES
	1/9/92	N/A	Benzene	< 1.0	N/A
			Toluene	< 1.0	N/A
			Ethylbenzene	< 1.0	N/A
			Xylenes	<2.0	N/A

N/A - Not applicable.

<sup>\*</sup> Dilution factor of 7.

U - Indicates compound was analyzed for, but not detected, at the given detection limit.

J - Indicates an estimated value when result is less than specified detection limit.

### 22 January 1992



### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sue Kent Dames & Moore 500 Market Place Tower 2025 First Avenue Seattle, WA 98121

RE: Client Project: #21048-006 ARI Job #9777

Dear Sue:

Please find enclosed the results and original chain-of-custody report for the above referenced project. Samples arrived in good condition on 1/10/92, and analyses proceeded without incident.

Samples MW-3 and MW-4 contained high levels of benzene, so the samples were diluted and re-analyzed. Both the initial and diluted results are included.

If you have any questions or need further information, please feel free to call any time. I can be reached at the number above, or direct at 340-2867, ext. 117, where you can also leave a message if I'm not available.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kate Stegemoeller Project Coordinator

DAMES & MOORE SEATTLE

JAN 23 1992

KAS/ks

**Enclosures** 

cc: file#9777



#### **ANALYTICAL RESOURCES INCORPORATED**

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490

(206) 621-7523 (FAX)

ORGANICS ANALYSIS DATA SHEET - Method 602/8020 **BETX by GC-PID** 

> Matrix: Water Level: Low

QC Report No: 9777-Dames &

Moore

Project No: 21048-006 Date Received: 1/10/92

Data Release Authorized: \_ Report prepared: 1/22/92 - MAC:K kas

		Γ	Method				MW-3
		Sample No.	Blank	MW-1	MW-2	MW-3	duplicate
		ARI ID	MB01/14	9777A	9777B	9777C	9777Cdup
		Date Analyzed	01/14/92	01/15/92	01/15/92	01/15/92	01/15/92
		Amt Analyzed	5.0 mls				
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	110	320 X	320 X
108-88-3	Toluene		1.0 U	1.0 U	1.0 U	3.8	3.8
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U	14	14
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U	17	17

**Surrogate Recoveries** 

Trifluorotoluene	93.9%	91.4%	102%	91.2%	92.7%
Bromobenzene	85.1%	89.8%	104%	100%	102%

		Sample No.	MW-4	MW-6	MW-7	MW-1dup	RB-011092
		ARI ID	9777D	9777F	9777G	9777H	97771
		Date Analyzed	01/15/92	01/15/92	01/15/92	01/15/92	01/15/92
		Amt Analyzed	5.0 mls				
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		630 X	1.0 U	1.7	1.0 U	1.0 U
108-88-3	Toluene		11	1.0 U	4.2	1.0 U	1.0 U
	Ethylbenzene		4.1	1.0 U	1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		17	2.0 U	2.0 U	2.0 U	2.0 U

**Surrogate Recoveries** 

Trifluorotoluene	91.2%	88.9%	80.1%	89.5%	82.4%
Bromobenzene	95.0%	83.9%	78.3%	85.6%	77.1%

### **Data Reporting Qualifiers**

Value If the result is a value greater than or equal to the detection limit, report the value.

- В This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when result is less than specified detection limit.





## ANALYTICAL **RESOURCES** INCORPORATED

Analytical Chemists &

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-7523 (FAX)

Consultants

QC Report No: 9777-Dames & (206) 621-6490

Moore

Project No: 21048-006 Date Received: 1/10/92

**BETX by GC-PID** Matrix: Water

Level: Low

Report prepared: 1/22/92 - MAC:K kas

ORGANICS ANALYSIS DATA SHEET - Method 602/8020

		Γ	Trip	Method		MW-3
		Sample No.	Blank	Blank	MW-5	dilution
		ARI ID	9777J	MB01/15	9777Ere	9777C 25X
		Date Analyzed	01/15/92	01/15/92	01/15/92	01/15/92
		Amt Analyzed	5.0 mls	5.0 mls	5.0 mls	0.2 mls
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	1.0 U	500
108-88-3	Toluene		1.0 U	1.0 U	1.0 U	25 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U	25 U
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U	50 U

**Surrogate Recoveries** 

Trifluorotoluene	83.6%	86.7%	96.7%	99.1%	
Bromobenzene	78.4%	76.8%	103%	97.6%	

			MW-3	MW-4
		Sample No.	dup. dilution	dilution
		ARI ID	9777Cdup 25X	9777D 50X
		Date Analyzed	01/15/92	01/15/92
		Amt Analyzed	0.2 mls	0.1 mls
CAS Num	ber	Units	μg/L	μg/L
71-43-2	Benzene		450	2700
108-88-3	Toluene		25 U	50 U
100-41-4	Ethylbenzene		25 U	50 U
1330-20-7	Total Xylenes		50 U	100 U

**Surrogate Recoveries** 

Trifluorotoluene	89.0%	94.7%
Bromobenzene	85.3%	85.7%

## **Data Reporting Qualifiers**

Value If the result is a value greater than or equal to the detection limit, report the value.

- В This flag is used when the analyte is f in the blank as well as a sample. Ind possible/probable blank contaminal
- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when r is less than specified detection limit.



# TOTAL PETROLEUM HYDROCARBONS WA HCID Method by GC/FID

# ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

QC Report No: 9777-Dames & Moore

Project: 21048-006

VTSR: 01/10/92

Matrix: Water

Data Release Authorized

Data Prepared: 1/14/92 - MAC: RPR

Date extracted: 01/13/92 Dates Analyzed: 01/13/92

Lai	b ID	Client Sample ID	Dilution Factor	Petroleum Hydrocarbons †	TPH ID *	Surrogate Recovery
MB	0103	Method Blank	T -	2.0 U	-	88.4%
9777	Α	MW - 1	-	2.0 U	No	130%
9777	В	MW - 2	-	2.0 U	No	98.2%
9777	С	MW - 3	-	2.0 U	No	79.9%
9777	D	MW - 4	-	2.0 U	No	98.4%
9777	E	MW - 5	-	2.0 U	No	99.5%
9777	F	MW - 6	-	2.0 U	No	98.5%
9777	G	MW - 7	-	2.0 U	No	93.6%
9777	Н	MW - 1 DUP	-	2.0 U	No	87.6%
9777	1	RB - 011092	-	2.0 U	No	128%

Surrogate is Me-Arachidate.

Values reported in ppm (mg/L).

- U Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- In the opinion of the analyst, was there a pattern match for diesel or gasoline (yes or no).
- † Value based on total peaks in the range from Toluene to C24.



## **Chain of Custody**

Date / / 10 /92 Page 1 of /

Project Number:	210	48-	006				Analysis Request														
Project Manager: Laboratory:	AR	<u>e k</u>	EUL			S				3.0		3									s
Turn around time: —	Reg	ular	•		्र §	attle	ν	lds S)		atic 10/83		7									ainer
					Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Aromatic Volatiles 602/8020	Base/Neutral/Acids 625/8270 (GC/MS)	15	Polycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8080	805 -HC 10		1		Priority Pollutant Metals (13)	EP TOX Metals (8)	1		Comments/ Instructions	Number of Containers
Sampler's Initials: Sampler's Signature: -		M	\		0 og	nater 10	. S &	eutra 70 (G	BTX 602/8015	arbo	S de s/F	8	×			8 € (£)	₹	,		IIIStructions	rof
	_			r	tatile 4/82	1/80	2/80	se/N 5/82	89 ×	drog	stick 8/80	TPH-	ETX			ority	9				<b>A</b>
Sample ID	Da	ate	Time	Matrix	88	五8	₹8	Ba 62.	BI	& Ì	88	F	8		ļ	ھ کے	⊞ ⊛				
MW-1	1/10	192	10:45	HZD	<u> </u>							/	/	]							3
MW-2			12:40									V	V								3
MW-3	1.1		10:00									V	1								3
MW-4	$\prod$		11:20									1	1								3
MW-5			14:10									1	V								3
MW- 6	11		14:45									1	1		<del>                                     </del>						3
MW-7	$\Box$		12:00	1-1			<u> </u>					/	1	<del> </del>			<b> </b>				3
MW-1 Dup.			10:45	11	<del>                                     </del>		<b>†</b>			<del>                                     </del>			1	1	<b> </b>		<u> </u>	<del>                                     </del>			3
RB-011092	+		11:45	-	<del>                                     </del>					1		/	1								3
Trip Blank	1,1-	1/92		1																	1
	1	1 -																			
	1				1	<del>                                     </del>									<u> </u>					**************************************	
	†			<del> </del> -	1		<b> </b>						<b>†</b> —				<del>                                     </del>				+
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Special Instructions/Co	omm	ents	·	<u> </u>	Relin	nquish	ed by:	<del></del>	<del></del>		1	Rece	eived b	y (lab	):	·	·	·	Sa	mple Receip	t
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THIRD QUARTERLY SAMPLING REPORT QUARTERLY GROUND-WATER MONITORING 7100 2ND AVENUE S.W. ALASKA MARINE LINES

For

ALASKA MARINE LINES JOB NO. 21048-004-005 May 15, 1992





500 MARKET PLACE TOWER, 2025 FIRST AVENUE, SEATTLE, WASHINGTON 98121 (206) 728-0744 FAX: (206) 448-7994

May 15, 1992

Alaska Marine Lines 7100 Second Avenue Seattle, Washington

Attn:

Mr. Bill Troy

President

Third Quarterly Sampling Event April, 1992 7100 Second Avenue Seattle, Washington

Dear Mr. Troy:

This letter report summarizes the findings and conclusions for the third quarterly sampling event at the 7100 Second Avenue site.

## **Monitoring Well Sample Collection**

Dames & Moore sampled the monitoring wells on April 9, 1992. The integrity of the samples was maintained by deconning all sample retrieval tools. Prior to sampling, all wells were purged using a decontaminated, hand-operated, BK pump. Decontamination procedures entailed scrubbing the bailer with alconox, an industrial soap, and thoroughly rinsing with deionized water. Groundwater samples were retrieved by using a decontaminated bailer. Temperature, pH, and specific conductivity readings were monitored during the well purging. These parameters indicate whether ground-water conditions have stabilized and whether samples are fresh. Parameters associated with purging the monitoring wells are listed in Table 1.

#### Water Levels

Water level measurements collected during sampling and during previous sampling events are tabulated on Table 2. The water level data are contoured on Figure 1.

## DAMES & MOORE

Alaska Marine Lines May 15, 1992 Page 2

## **Laboratory Results**

The ground-water samples were analyzed for total petroleum hydrocarbons, scanning for diesel and gasoline range hydrocarbons (TPH-D and TPH-G; EPA 8015) and benzene, toluene, ethylbenzene, and xylene (BTEX; EPA modified 8020) by Analytical Resources Incorporated located in Seattle, Washington. Table 3 presents the analytical results from this sampling event and the analytical results from previous sampling events.

## **Ground-Water Quality Assurance/Quality Control Samples**

Results of ground-water QA/QC analysis are reported in Table 4. Analytical results were reproducible as shown by the results for duplicate well samples from MW-6. A rinse sample from the bailer shows no detection of BTEX or TPH compounds. Trip samples were also confirmed clean of contamination.

We will notify your facilities of our expected fourth quarterly sampling dates one week in advance. Please call if you have any questions.

Sincerely,

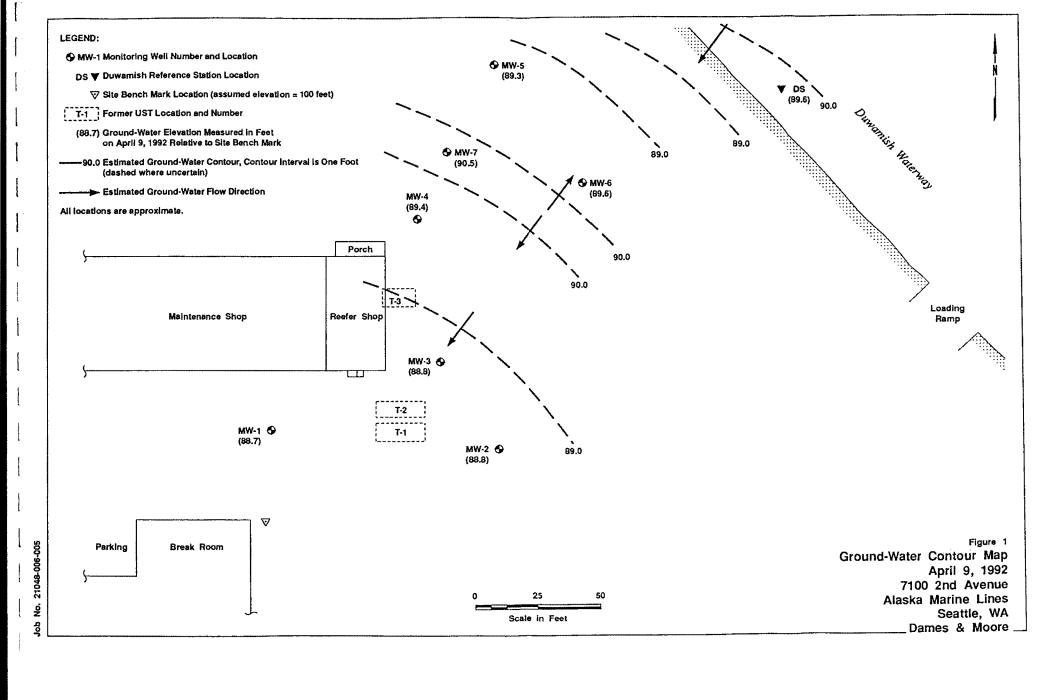
DAMES & MOORE, INC.

Myrid H. Williams.

Ingrid M. Williams
Staff Hydrogeologist

Gusus C. Kent

Susan C. Kent Project Manager



# TABLE 1 GROUND-WATER SAMPLING DATA THIRD QUARTERLY SAMPLING EVENT 7100 2nd Avenue Alaska Marine Lines

WELL NO.	DATE	TIME	pH (-log H ')	T (°C)	SC (µS)	Well Vol (mV)	Purge Vol (gal)	Method	Remarks
MWI	4/09/92	08:38	7.35	13.3	-23.6	5.8	18	BK Pump	slight hydrocarbon odor; H <sub>2</sub> S odor
MW2	4/09/92	08:47	7.38	13.4	-24.8	6.4	18	BK Pump	strong H <sub>2</sub> S odor
MW3	4/09/92	08:30	7.93	13.2	-52.3	6.5	18	BK Pump	strong hydrocarbon odor; H <sub>2</sub> S odor
MW4	4/09/92	10:22	7.75	12.0	-42.5	1.5	18	BK Pump	distinct hydrocarbon odor
MW5	4/09/92	10:10	8.02	11.7	-59.0	1.7	5	BK Pump	Poor recovery of water in well; H <sub>2</sub> S odor
MW6	4/09/92	09:05	7.32	12.8	-19.6	1.5	5	BK Pump	Poor recovery of water in well; no odor
MW7	4/09/92	09:25	7.55	11.4	-30.3	2.0	5	BK Pump	Poor recovery of water in well; no odor

# TABLE 2 SUMMARY OF WATER LEVEL DATA THIRD QUARTERLY SAMPLING EVENT 7100 Second Avenue Alaska Marine Lines

			WATER LEVEL	ELEVATION <sup>2</sup>		
WELL NO.	November 1, 1990	January 15, 1991	January 25, 1991	September 5, 1991	January 10, 1992	April 8, 1992
MW-1	87.87	88.70	88.31	88.23	88.73	88.74
MW-2	88.18	89.08	88.40	88.26	88.82	88.82
MW-3	87.89	88.75	88.43	88.29	87.81	88.81
MW-4	88.45	89.31	89.22	89.09	88.92	89.42
MW-5	N/A	89.57	89.11	N/A¹	89.48	89.32
MW-6	N/A	89.66	89.05	N/A <sup>1</sup>	90.93	89.63
MW-7	N/A	90.50	90.48	90.31	90.42	90.48
PIER	N/A	87.94	89.25	N/A	90.77	89.57

## N/A Not Analyzed

Well covered with asphalt on 9/5/91

Water elevations are relative to the site bench mark, which is the yellow-painted obstruction post located west of the voltage transformer on the south side of the site. The site bench mark is assigned an arbitrary elevation of 100.00 feet.

Table 3
Summary of Ground-Water Analytical Data
7100 Second Avenue
Alaska Marine Lines

						Analysis		
Well	Sampling	TPH	TPH-D1	TPH-G2	Benzene	Toluene	Ethylbenzene	Xylenes
Number	Date	mg/l	mg/l	mg/i	ug/l	ug/l	ug/l	ug/I
MW-1	11/1/90	0.59	NA	NA NA	<1.0	<1.0	<1.0	<1.0
	12/18/90	NA	NA	NA NA	NA NA	NA	NA	NA NA
	9/5/91	<10.0	NA NA	NA	<1.0	<1.0	<1.0	<2.0
	1/10/92	<2.0	NA	NA	<1.0	<1.0	<1.0	<2.0
	4/9/92	NA	<0.25	<0.25	<1.0	<1.0	<1.0	<2.0
	i							
MW-2	11/1/90	0.56	NA	NA	<1.0	<1.0	<1.0	<1.0
	12/18/90	NA	NA	NA	NA NA	NA	NA NA	NA
	9/5/91	<10.0	NA	NA NA	88	<1.0	<1.0	<2.0
	1/10/92	<2.0	NA	NA NA	110	<1.0	<1.0	<2.0
	4/9/92	NA	0.58	الـ0.14	65	<1.0	<1.0	<2.0
	1							
MW-3	11/1/90	0.33	NA	NA	<1.0	<1.0	1,1	5.3
	12/18/90	NA	NA	NA	420	3.5	13	48.4
	9/5/91	<10.0	NA	NA NA	630*	3.2	16	25
	1/10/92	<2.0	NA	NA NA	500*	3.8	14	17
	4/9/92	NA	<0.25	0.721	620*	3	9.1	18
MW-4	11/1/90	0.027	NA	NA	4200	8.3	2.1	4.2
	12/18/90	NA	NA	NA NA	3600	<50	<b>&lt;</b> 50	63
	9/5/91	NA	NA NA	NA	2000	12	<1.0	19
	1/10/92	<2.0	NA	NA NA	2700*	11	4.1	17
	4/9/92	NA	<0.25	الـ0.15	1800*	6.2	<1.0	5.7
					<u> </u>			
MW-5	11/1/90	NA	NA	NA	NA	NA	NA	NA
	12/18/90	NA	NA	NA NA	<5.0	<5.0	<5.0	<5.0
	9/5/91	NA	NA	NA NA	NA	NA	NA	NA
	1/10/92	<2.0	NA NA	NA NA	<1.0	<1.0	<1,0	<2.0
	4/9/92	NA	<0.25	<0.25	<1.0	<1.0	<1.0	<2.0
MW-6	11/1/90	NA	NA	NA	NA	NA	NA	NA
	12/18/90	NA	NA	NA NA	<5.0	<5.0	<5.0	<5.0
	9/5/91	NA	NA NA	NA NA	NA	NA	NA	NA .
	1/10/92	<2.0	NA	NA	<1.0	<1.0	<1.0	<2.0
	4/9/92	NA	4.21	<0.25	<1.0	<1.0	<1.0	<2.0
	<u> </u>							
MW-7	11/1/90	NA	NA	NA	NA	NA	NA	NA
	12/18/90	NA	NA NA	NA	<5.0	<5.0	<5.0	<5.0
	9/5/91	<10.0	NA NA	NA	3.4	79	<1.0	<2.0
	1/10/92	<2.0	NA NA	NA NA	1.7	4.2	<1.0	<2.0
	4/9/92	NA	6.61	<0.25	1.6	<1.0	<1.0	<2.0
	]							
	<u> </u>							
MTCA <sup>2</sup>	<u> </u>	1	1	1	5	40	30	20

<sup>1 -</sup> In the opinion of the laboratory analyst, there was no chromatographic pattern match for diesel or gasoline.

Numbers in bold indicate a concentration at or above the MTCA cleanup levels.

The value shown is the concentration obtained following the required dilution.

<sup>2</sup> MTCA- The Model Toxics Control Act Cleanup Regulation, effective February 28, 1991.

<sup>&</sup>lt; - This parameter was not detected at a concentration above the detection level indicated in the table.

NA - Not Analyzed

<sup>\* -</sup> Indicates the initial analysis of the sample was above the linear range of the analytical instrument.

## TABLE 4 SUMMARY OF GROUND-WATER QA/QC ANALYTICAL DATA 7100 Second Avenue Alaska Marine Lines

DUPLICATE	SAMPLING	WELL	ANALYSIS	SAMPLE	DUPLICATE
WELL	DATE	NO.		VALUES	VALUES
SAMPLES	4/9/92	MW-6	Benzene Toluene Ethylbenzene Xylenes TPH - Diesel TPH - Gasoline	<1.0 μg/L <1.0 μg/L <1.0 μg/L <2.0 μg/L 4.2 ppm <0.25 ppm	<1.0 μg/L <1.0 μg/L <1.0 μg/L <2.0 μg/L 4.6 ppm <0.25 ppm

RINSATE	SAMPLING	WELL	ANALYSIS	SAMPLE	DUPLICATE
SAMPLES	DATE	NO.		VALUES	VALUES
	4/9/92	N/A	Benzene Toluene Ethylbenzene Xylenes TPH - Diesel TPH - Gasoline	<1.0 μg/L <1.0 μg/L <1.0 μg/L <2.0 μg/L <0.25 ppm <0.25 ppm	N/A N/A N/A N/A N/A

TRIP	SAMPLING	WELL	ANALYSIS	SAMPLE	DUPLICATE
BLANK	DATE	NO.		VALUES	VALUES
	4/9/92	N/A	Benzene Toluene Ethylbenzene Xylenes	<1.0 μg/L <1.0 μg/L <1.0 μg/L <2.0 μg/L	N/A N/A N/A N/A

N/A - Not applicable.

U - Indicates compound was analyzed for, but not detected, at the given detection limit.

J - Indicates an estimated value when result is less than specified detection limit.

 $\mu g/L$  - micrograms per liter ppm - parts per million

23 April 1992



DAMES & MOORE SEATTLE APR 24 1992 ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Ingrid Williams Dames & Moore 500 Market Place Tower 2025 First Avenue Seattle, WA 98121

RE: Client Project: Alaska Marine Lines ARI Job #A420

Dear Ingrid:

Please find enclosed the results and original chain-of-custody records for the above referenced project. Nine samples were received in good condition on 4/9/92.

BETX samples MW-3 and MW-4 required re-analysis at dilution due to levels of benzene above the instrument calibration range. Values for all the runs are reported here. The analyst notes that diesel samples MW-6, MWX-6, and MW-7 appear to have hydrocarbons in the motor oil range. Analysis by Method 418.1 could be used to achieve more accurate quantitation of these levels.

If you have any questions or need further information, please feel free to call any time.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kate Stegemoeller Project Coordinator 206-340-2867, ext. 117

Kale Sheemor

KAS/ks

**Enclosures** 

cc: file#A420



## ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

QC Report No: A420-Dames&Mod<sup>266</sup>) 621-7523 (FAX)

Project: Alaska Marine Lines

VTSR: 04/09/92

TOTAL DIESEL RANGE HYDROCARBONS WA TPHD Method by GC/FID

Data Release Authorized

Matrix: Waters

Data Prepared: 04/14/92 - MAC:C PAT

Date Extracted: 04/10/92 Dates Analyzed: 04/13-14/92

Lab ID	Client Sample ID	Dilution Factor	Diesel Hydrocarbons †	Diesel ID *	Surrogate Recovery
A420 MB	Method Blank	1	0.25 U	No	106%
A420 A	MW-1	1	0.25 U	No	112%
A420 B	MW-2	1	0.58	Yes	114%
A420 C	MW-3	1	0.25 U	No	106%
A420 D	MW-4	1	0.25 U	No	113%
A420 E	MW-5	1	0.25 U	No	110%
A420 F	MW-6	1	4.2	No	61.3%
A420 G	MWX-6	1	4.6	No	79.4%
A420 H	MW-7	1	6.6	No	93.3%
A420 I	RB-040992	1	0.25 U	No	103%
A420 IDUP	RB-040992 DUPL.	1	0.25 U	No	119%

Surrogate is Me-Arachidate.

Values reported in ppm (mg/L).

- S Indicates no value reported due to saturation of the detector.
- U Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- \* In the opinion of the analyst, was there a pattern match for diesel.
- † Value based on total peaks in the range from C12 to C24.



# TOTAL GASOLINE RANGE HYDROCARBONS BY GC/FID WA TPH-G Method (Purge & Trap)

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

QC Report No: A420-Dames & Moore

Project: Alaska Marine Lines

VTSR: 04/09/92

Matrix: Waters

Data Release Authorized\_

Data Prepared: 04/23/92 MAC:D

Date Analyzed: 04/16,17,20/92

			Dilution	Gasoline Range		Surrogate	Surrogate
Lab	ID	Client Sample ID	Factor	Hydrocarbons †	Gas ID *	Α	В
A420	MB	Method Blank	NA	0.25 U	No	94.3%	90.2%
A420	Α	MW-1	NA	0.25 U	No	92.9%	91.6%
A420	С	MW-3	NA	0.72	No	90.2%	97.7%
A420	D	MW-4	NA	0.15 J	No	93.0%	96.7%
A420	D dup	MW-4 dup	NA	0.15 J	No	85.6%	90.0%
A420		RB-040992	NA	0.25 U	No	92.1%	88.4%
A420	MB	Method Blank	NA	0.25 U	No	95.2%	97.0%
A420	В	MW-2	NA	0.14 J	No	101%	97.6%
A420	E	MW-5	NA	0.25 U	No	101%	99.6%
A420	F	MW-6	NA	0.25 U	No	90.9%	86.2%
A420	G	MWX-6	NA	0.25 U	No	94.6%	90.9%
A420	Н	MW-7	NA	0.25 U	No	97.6%	95.5%

Surrogate A = Trifluorotoluene Surrogate B = Bromobenzene

Values reported in ppm (mg/L).

- U Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- In the opinion of the analyst, was there a pattern match for gasoline (yes or no).
- † Value based on total peaks in Toluene-C12 range.
- J Indicates an estimated value when result is less than specified detection limit.



## ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

# ORGANICS ANALYSIS DATA SHEET BETX by Method 602/8020

Matrix: Water Level: Low Project No: Alaska Marine Lines

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Data Release Authorized:

Report prepared: 04/22/92 - MAC: RPR

QC Report No: A420-Dames & Moore

VTSR: 4/9/92

Instrumen	t ID: GC/PID	Sample No.	Method Blk	Method Blk	Method Blk	MW-1	MW-2
		ARI ID	MB 0415	MB 0416	MB 0420	A420 - A	A420 - B
		Date Analyzed	4/15/92	4/16/92	4/20/92	4/16/92	4/16/92
		Amt Analyzed	5.0 ml	5.0 ml	5.0 ml	5.0 ml	5.0 ml
CAS Number		Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	1.0 U	1.0 U	65
108-88-3	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
·		Trifluorotoluene	105%	89.5%	78.3%	97.1%	94.4%
		Bromobenzene	102%	94.3%	80.0%	98.5%	95.6%

Instrumen	t ID: GC/PID	Sample No.	M W - 3	M W - 3	M W - 4	M W - 4 dup	M W - 4 dl
		ARLID	A420 - C	A420 - C dl	A420 - D	A420 - D Dup	A420 - D dl
		Date Analyzed	4/16/92	4/20/92	4/16/92	4/16/92	4/22/92
		Amt Analyzed	5.0 ml	0.5 ml	5.0 ml	5.0 ml	0.1 ml
CAS Number Units			μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		220 X	620	370 X	370 X	1800
108-88-3	Toluene		3.0	10 U	6.2	6.0	50 U
100-41-4	Ethylbenzene		9.1	10 U	1.0 U	1.0 U	50 U
1330-20-7 Total Xylenes			18	20 U	5.7	5.1	100 U
		Trifluorotoluene	93.5%	97.5%	96.4%	88.9%	91.6%
		Bromobenzene	105%	98.1%	102%	94.8%	96.7%

## GC DATA QUALIFIERS

- U Indicates the compound was undetected at the listed concentration.
- J Indicates an estimated value when the value is less than the calculated detection limit.
- D Indicates the surrogate(s) was not detected, due to dilution of extract.
- NR Indicates the surrogate recovery cannot be reported due to matrix interference.
- X Indicates a value above the linear range of the detector. Dilution required.
- \$ Indicates no value reported due to saturation of the detector. Dilution required.
- C Indicates a probable value which is unable to be confirmed due to matrix interference



## ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

## ORGANICS ANALYSIS DATA SHEET BETX by Method 602/8020

Matrix: Water Level: Low

Data Release Authorized:

Report prepared: 04/22/92'- MAC: RPR

QC Report No: A420-Dames & Moore

Project No: Alaska Marine Lines

VTSR: 4/9/92

Instrumer	nt ID: GC/PID	Sample No.	M W - 5	MW-6
		ARI ID	A420 - E	A420 - F
		Date Analyzed	4/17/92	4/17/92
		Amt Analyzed	5.0 ml	5.0 ml
CA\$ Num	ber	Units	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U
108-88-3	Toluene		1.0 U	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	2.0 U
		Trifluorotoluene	93.1%	83.9%
		Bromobenzene[	96.2%	85.0%

Instrumen	t ID: GC/PID	Sample No.	MWX-6	M W - 7	RB-040992
		ARI ID	A420 - G	A420 - H	A420 - I
		Date Analyzed	4/17/92	4/17/92	4/16/92
		Amt Analyzed	5.0 ml	5.0 ml	5.0 ml
CAS Num	ber	Units	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.6	1.0 U
108-88-3	Toluene		1.0 U	1.0 U	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U
		Trifluorotoluene	85.8%	89.3%	86.3%
		Bromobenzene[	87.6%	92.1%	90.9%

## GC DATA QUALIFIERS

- U Indicates the compound was undetected at the listed concentration.
- J Indicates an estimated value when the value is less than the calculated detection limit.
- D Indicates the surrogate(s) was not detected, due to dilution of extract.
- NR Indicates the surrogate recovery cannot be reported due to matrix interference.
- X Indicates a value above the linear range of the detector. Dilution required.
- \$ Indicates no value reported due to saturation of the detector. Dilution required.
- C Indicates a probable value which is unable to be confirmed due to matrix interference

## Chain of Custody Record & **Laboratory Analysis Request**

**RESOURCES INCORPORATED** 

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (20A) A21-7523 (EAX)

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2	MW-2		1500		1	B	1	V	/								7-17-1
3	MW-3		1105			C	V	/	1								
4	MW-4		1135			D	1	1	V								
5_	MW-5		1300			I E	1	/	V								
6	mul-6		1345			F	V	/	1								
7	MWX-4		B45			6	/	/	1						Field	Duplicate	<u></u>
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# Chain of Custody Record & Laboratory Analysis Request

Date: 4/9/92



RESOURCES INCORPORATED

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Page 2 of 2 333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

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FOURTH QUARTERLY SAMPLING EVENT AND ANNUAL MONITORING REPORT 7100 SECOND AVENUE S.W. SEATTLE, WASHINGTON

For

ALASKA MARINE LINES Job No. 21048-006-005 November 5, 1992





500 MARKET PLACE TOWER, 2025 FIRST AVENUE, SEATTLE, WASHINGTON 98121 (206) 728-0744 FAX: (206) 727-3350

November 6, 1992

Mr. Bill Troy Alaska Marine Lines 7150 - 2nd Avenue S.W. Seattle, Washington 98106

> Report Fourth Quarterly Sampling Event and Annual Monitoring Report 7100 Second Avenue Southwest 5615 West Marginal Way Southwest Alaska Marine Lines 21048-006-005

Dear Mr. Troy:

Transmitted herewith are two copies of our report entitled Fourth Quarterly Sampling Event and Annual Monitoring Report for the 7100 Second Avenue Southwest and the 5615 West Marginal Way Southwest facilities. The reports summarize Dames & Moore's quarterly monitoring activities conducted between September 1991 and August 1992 and presents our conclusions and recommendations.

These reports are final subject to your approval. If you should wish for us to amend these reports please contact our office at your earliest convenience so that we may discuss any modifications. We trust this report meets your current requirements. Dames & Moore appreciates the opportunity to assist you on this important project.

Respectfully submitted,

**DAMES & MOORE** 

MWilliaen.

Ingrid M. Williams

Project Manager

cc: Bob Strong, Lynden, Inc.

#### **EXECUTIVE SUMMARY**

This report documents the activities and findings of four quarterly ground-water monitoring events conducted by Dames & Moore for Alaska Marine Lines (AML) at its facility at 7100 2nd Avenue S.W., Seattle, Washington. Project objectives were to map the horizontal extent of petroleum hydrocarbons and constituents in site groundwater, to evaluate the potential rate and direction of migration of the contaminants, and consider potential risks to human and ecological health associated with contaminated groundwater on site. The work has been conducted in accordance with the Model Toxics Control Act Cleanup Regulation effective February 28, 1991 (MTCA).

## Project activities are listed below:

- Sampled seven ground-water monitoring wells;
- Analyzed ground-water samples for presence of diesel, gasoline, and petroleum constituents;
- Measured water levels in on-site monitoring wells; and,
- Conducted permeability tests and 24-hour water level survey in on-site wells.

## Extent and Concentration of Petroleum in Groundwater

- Concentrations of benzene, toluene, xylene, and diesel in groundwater have been detected above MTCA Method A cleanup guidelines in several on site wells;
- Benzene concentrations remained consistently high throughout the sampling period relative to MTCA Method A cleanup guidelines;
- Diesel concentrations in affected wells were at or below MTCA Method A cleanup guidelines; and,
- Toluene and xylene concentrations in affected wells decreased over the monitoring period to below MTCA Method A cleanup guidelines.

## Migration Rate and Direction of Groundwater

- Ground-water levels fluctuate in response to tides occurring in the Duwamish Waterway;
- Ground-water flow direction from beneath the site is northeasterly and southerly (directly northeast to the Duwamish or to a slip just south of the site). Ground-water flow appears to divide midway across the site near MW-7. Ground-water movement northwest of MW-7 flows toward the Duwamish and movement south of MW-7 occurs toward the slip; the ground-water gradient fluctuates daily in response to tidal influences; and,

7100 Second Avenue S.W.

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Ground-water flow velocities from the site toward the Duwamish is estimated to range between 0.02 to 0.06 feet/day (7 to 22 feet/year). At this flow rate, groundwater near MW-6 could reach the Duwamish waterway within ten years.

#### Contaminant Fate

- Benzene concentrations may fluctuate due to apparent tidal influences;
- The absence of detectable benzene in downgradient wells close to the Duwamish Waterway supports the low ground-water velocity evidenced;
- Decreasing toluene and xylene concentrations during the monitoring period suggest that natural biodegradation, dispersion and/or adsorption processes are removing residual petroleum constituents from on-site groundwater; and,
- We would expect that such attenuation mechanisms will further decrease residual petroleum concentrations in the future.

## Regulatory Concerns

- MTCA Method A ground-water cleanup guidelines for benzene and diesel are currently exceeded.
   Diesel concentrations are relatively low compared to clean-up levels, however benzene concentrations are relatively high.
- The Duwamish Waterway is the potential receptor (receiving water) of residual benzene and diesel contaminated groundwater migrating beneath the site. Ecologic risk resulting from ground-water discharge into the Duwamish is expected to be low due to the apparent attenuation processes. A baseline ecological risk assessment has not been performed. There does not appear to be an immediate risk either ecologically or to human health.

#### Recommendations

Based on our observations, we have developed the following recommendations:

- Due to removal of sources and apparent attenuation of the residuum, site conditions are likely to improve; additional monitoring on a less frequent basis could provide evidence of on-going improvement, therefore we recommend monitoring for diesel and BTEX only in ground-water samples from site wells twice a year;
- Since changes in land use could alter the ground-water conditions prior to natural reduction in
  petroleum residuum, an action plan is recommended. The action plan should include procedures
  to monitor and protect on-site workers from exposure to the residuum during removal of the paving,
  utility trenching, or other potential construction activities;
- Monitoring data and reviews of conditions (at least annually) should be kept for review by Ecology and site managers.

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	Third Quarterly Sampling Events
Appendix B	Analytical Laboratory Reports
Appendix C	Slug Test Data

## 1.0 INTRODUCTION

Presented in this report are quarterly ground-water sampling results and monitoring services for the period of February, 1991 to August, 1992 at Alaska Marine Lines (AML) facility at 7100 2nd Avenue S.W., Seattle, Washington (Figure 1). The purpose of this report is to present the results of the fourth quarterly ground-water sampling event, summarize the data from three previous quarterly ground-water sampling events, and present our findings relative to on-site hydrogeology.

This report has been prepared for use by Alaska Marine Lines and review by the Washington State Department of Ecology.

#### 1.1 SITE LOCATION

The AML site is a barge loading facility where cargo and refrigerated containers are transferred between barges and trucks. The site is roughly triangular in shape and is bounded on the northeast by the Duwamish Waterway, on the south by a slough and Northwest Cooperage, and on the west by off- and on-ramps for the First Avenue Bridge. The site is relatively level and entirely paved.

## 1.2 SITE BACKGROUND

Three underground storage tanks (USTs) have been removed from the site since acquisition by AML. One tank was removed in 1984 at the time AML acquired the property, and two were removed in 1991. The removal of two tanks in 1991 was monitored by Dames & Moore and recorded in our report entitled Tank Closure Report, 7100 Second Avenue S.W., Seattle, Washington. To evaluate the nature and extent of petroleum constituents in the subsurface in the area of the USTs, Dames & Moore conducted a site assessment which is outlined in our report entitled Soil and Ground-water Assessment, 7100 Second Avenue Southwest, Seattle, Washington dated March 6, 1991.

## 1.3 PROJECT OBJECTIVES AND APPROACH

The objective of this report is to map the horizontal extent and concentration of residual petroleum hydrocarbons and constituents in site groundwater. Ground-water monitoring conducted since September 1991 on a quarterly basis (and monitoring results collected from November and December 1990 during the initial phase of the project), has provided the data base to evaluate movement of residual petroleum in site groundwater.

The scope of work completed for this report included the following tasks, and was based on findings from the previous site investigation and the requirements of the Washington Model Toxics Control Act (MTCA) and Department of Ecology (Ecology) for leaking USTs.

- Collect ground-water samples from monitoring wells MW-1 through MW-7 and submit for chemical analysis on a quarterly basis for one year;
- Collect ground-water elevations on a quarterly basis for one year;

7100 Second Avenue S.W.

- · Perform permeability tests to determine on-site soil hydraulic conductivities; and,
- Monitor ground-water elevations for a 24-hour period in all monitoring wells and at the Duwamish River to evaluate tidal influences on site ground-water flow.

Permeability tests allowed Dames & Moore to estimate ground-water flow directions and rates, evaluate confining conditions, and estimate petroleum transport rates. This document presents a review of the compiled data for the fourth quarter and a summary of the monitoring year.

The suspected source of ground-water contamination was leakage from removed gasoline and diesel underground storage tanks. Therefore, ground-water samples were analyzed for the presence of TPH (diesel and gasoline) and the petroleum constituents: benzene, toluene, ethylbenzene, and xylene.

## 2.0 METHODS OF FIELD ASSESSMENT

## 2.1 WELL SAMPLING AND WATER QUALITY PARAMETERS

Monitoring wells MW-1 through MW-7 were sampled on a quarterly basis for one year. All samples were collected using a disposable teflon bailer. Samples were collected after at least three casing volumes of water were purged from the well and pH, temperature, and specific conductivity measured in the field showed less than 10% variation on three replicate grab samples. All samples were placed in clean jars provided by the laboratory and analyzed for WTPH-D (diesel), WTPH-G (gasoline), and BTEX.

Lower reported detection limits for TPH between the third and fourth quarterly samples and previous samples are a result of the analytical methods. Newly established Washington methods WTPH-G and WTPH-D were used for the analyses after January 1992.

Field sampling parameters for the fourth quarterly sampling event are presented in Table 2 and all the analytical data obtained to date are summarized in Table 3. Quality assurance\quality control data for the fourth quarterly sampling event is presented in Table 4.

During the fourth quarterly sampling event, values of pH ranged between 6.83 (MW-6) to 7.29 (MW-2 and MW-7); temperature ranged between 15.3 °C (MW-4) to 21.2 °C (MW-5), and specific conductivity ranged between 1401 uS (MW-4) to 4200 uS (MW-6). Water quality in MW-6 displayed a consistently low pH and high specific conductivity compared with the other wells sampled. Variability of specific conductance, pH and temperature in wells may be due in part to brackish water from the Duwamish River migrating beneath the site during high tide, evidenced by MW-6, which is the closest well to the Duwamish.

## 2.2 WATER LEVEL MONITORING

Water levels were measured during each quarterly sampling event and over one 24-hour period. All water level measurements were completed prior to sampling and were collected within a 30 minute period to avoid tidal effects on water level. Water levels in each monitoring well were recorded using an electronic water level indicator.

All water level readings are measured relative to an on-site benchmark arbitrarily assigned an elevation of 100 feet and are not reported relative to sea level.

## 2.3 PERMEABILITY TESTS

Hydraulic conductivity tests were performed in selected on-site wells in August, 1992. Test results are given in Appendix C. The test measures the rate of water level recovery in a well with respect to time. The test is commonly referred to as a "slug test".

The test data of water level versus time was analyzed using the Horslev (1951) method as presented in Groundwater, 1979, Freeze, R.A. and J.A. Cherry. Table 5.0 presents test results.

## 3.0 RESULTS AND DISCUSSION

#### 3.1 GEOLOGY

Site soils are characterized as chiefly sand and silt (fill) mantling deltaic or river bank sediments. These soils are either hydraulic fill or river deposition. Detailed descriptions of the geologic environment have previously been presented in our report Soil and Ground-water Assessment, 7100 Second Avenue Southwest, Seattle, Washington dated March 6, 1991.

#### 3.2 GROUND-WATER LEVELS

Water level measurements were collected in all on-site wells during each sampling round. In addition, water levels were measured over a 24-hour time period in August, 1992 to evaluate tidal influences on groundwater. Tide level changes in the Duwamish Waterway were measured from a pier extending off of AML property. Water levels were measured once per half hour. Test results are presented in Table 5 and graphical presentation of water level changes through time is shown on Figure 6.

Tide level readings measured in the Duwamish from the pier extending off AML property into the waterway fluctuated between 81 feet to 91.5 feet. Corresponding changes in water levels measured were observed in all the on-site wells ranging from a low of 0.07 feet (MW-7) to a high of 0.64 feet (MW-5).

Water level fluctuations in the Duwamish display a sinusoidal curve consisting of two peaks that correspond to two daily tidal cycles (Figure 6). Ground-water elevations display a similar sinusoidal curve, although ground-water fluctuations are delayed and the amplitude is greatly reduced. These results are consistent with the expected fluctuations based on tidal influence, with water level response to tidal fluxes depending on the distance from the Duwamish, the permeability of the sediments and the hydraulic connection between the sediments and the Duwamish.

Also the 24-hour water level measurement results demonstrate that tidal influences affect water levels most significantly in wells adjacent to the waterway (e.g., MW-5 and MW-6) with decreasing effect on wells at greater distances from the surface water body. Ground-water flow in the portion of the site closest to the Duwamish is affected primarily by water level changes in the Duwamish caused by tidal fluctuations.

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Water level in MW-7 shows very little, if any response to tidal flux, indicating that it is more isolated from the tidal affect, and had higher water levels than surrounding wells. This may result from a leaking storm sewer or water line and also may indicate a low permeability zone perching or impeding flow of groundwater in the vicinity of this well. There does not appear to be any rainfall recharge on site due to asphalt covering the ground.

Quarterly water level results are presented in Table 1. In general, water levels peaked during mid-winter to mid-spring (January through April, 1992 readings) and displayed low water levels during late summer through late fall (August, 1992 and November, 1990 values) (Table 1). Minimum and maximum groundwater level fluctuations ranged between 0.26 feet in MW-5 and 1.88 feet in MW-6.

Ground-water contour maps for each quarterly sampling period are presented in Figures 2 through 5. In addition, ground-water contour maps displaying ground-water level and flow direction at 4-hour intervals measured during the 24-hour tidal investigation are shown in Figures 7 through 13.

### 3.3 GROUND-WATER FLOW DIRECTION

In general, ground-water flow direction from beneath the site is northeasterly and southerly (directly northeast to the Duwamish or to a slip just south of the site) as indicated on Figure 2. The groundwater flux indicates a dynamic and spatially variable condition, resulting from regional recharge and topographic conditions, and locally due to tidal flux in the Duwamish. All the wells show mean water levels above the mean high tide level, indicating a net flow towards the Duwamish.

Groundwater levels in wells on the southern portion of the site are lower than levels on the north, indicating that groundwater flows southerly towards the slip on the south boundary of the site, and that groundwater on the north side of the site discharges directly into the Duwamish. Well MW-7 appears to be located near a groundwater divide beneath the site where ground-water movement northwest of MW-7 flows toward the Duwamish and movement south of MW-7 occurs toward the slip (Figures 3, 4, and 5).

On a daily basis, ground-water flow direction is reversed near the Duwamish in response to high tides. Water levels in the Duwamish and in wells closest to the Duwamish (MW-5) exhibited higher water elevations compared to wells further inland during each high tide period.

### 3.4 GROUND-WATER VELOCITY

The ground-water velocity in unconsolidated sediments is controlled by the hydraulic conductivity, porosity, and the hydraulic gradient within the aquifer. The average hydraulic gradient measured at the site is 0.018 to 0.047 foot per foot. Based on the permeability test results presented in Table 5.0, the average hydraulic conductivity is estimated to be 0.46 feet per day. Assuming an effective porosity of 0.35 for fine sand, the average velocity of a particle within the aquifer is estimated to be 0.02 to 0.06 feet per day.

At this velocity it would take 3.3 to 8.7 years for a molecule of water to travel horizontally from MW-6 to the Duwamish Waterway. Since the water bearing material fines downward the vertical hydraulic conductivity is expected to be lower than the horizontal.

7100 Second Avenue S.W.

## TABLE 5.0 ESTIMATED HYDRAULIC CONDUCTIVITY

MONITORING WELL	HYDRAULIC CONDUCTIVITY ESTIMATE (FEET/DAY)		
MW-1	0.13		
MW-4	1,20		
MW-5	0.10		
MW-6	0.43		

## 3.5 MIGRATION RATE AND DIRECTION OF CONTAMINANTS

As previously indicated, ground-water flow direction from beneath the site is generally to the northeast and south towards the Duwamish Waterway (directly northeast to the Duwamish or to a slip just south of the site). Net flow of groundwater appears to be towards the Duwamish Waterway based on water level measurements. Average water level in the Duwamish is lower than average water levels in on-site groundwater monitoring wells indicating net flow towards the surface water body.

The ground-water migration rate from beneath the site to the Duwamish has been estimated to be on the order of 0.02 to 0.06 feet/day (7 to 22 feet/year). This estimate is based on an average hydraulic head between MW-7 and the Duwamish. The gradient fluctuates daily in response to tidal influences. At this flow rate, contaminated groundwater near MW-6 could reach the Duwamish waterway within ten years.

Although contaminants will travel in the direction of ground-water flow, contaminant flow velocities do not necessarily match these values due to retardation and other attenuation factors. Contaminant flow velocities are dependant on chemical properties of the contaminant, soil type, and other soil parameters. Attenuation mechanisms which primarily affect contaminant flow are natural biodegradation and adsorption.

The migration of the contaminants appears to be slow, and contaminant concentrations during sampling are erratic depending on the tidal flux. Dispersion of the contaminants would likely be a mechanism of plume migration in these conditions, resulting in a general spreading out of the petroleum constituents towards the slip or directly towards the Duwamish. Because the source is removed (former USTs), we would expect concentrations to decrease over time, although due to the dynamic conditions, concentrations in a particular well may fluctuate.

## 3.6 ANALYTICAL RESULTS

## 3.6.1 Total Petroleum Hydrocarbon (TPH) Concentrations

Fourth quarter analytical results showed TPH ranging from 0.28 to 1.1 mg/L (diesel) and 0.22 to 0.31 mg/L (gasoline). Neither gasoline nor diesel concentrations exceeded MTCA Method A cleanup guidelines during the fourth quarter except one sample (MW-6) which had a concentration of diesel (1.1 mg/L) slightly elevated above the state MTCA Method A ground-water guideline for diesel of 1 mg/L.

Similar to third quarterly analytical results, however, the analytical laboratory indicates that detected TPH during the fourth quarter (August 1992) appears to be neither diesel or gasoline, but may indicate the presence of a heavier petroleum such as motor oil, or a residual hydrocarbon component of diesel.

Over the sampling period detectable quantities of diesel were found in MW-2, MW-3, MW-5, MW-6, and MW-7. Also during the sampling period, detectable concentrations of gasoline were found in MW-2, MW-3, and MW-4. Concentrations of TPH as diesel and gasoline were below MTCA Method A cleanup guidelines (1 mg/L) during the four quarters except the exceedence listed above and two exceedences (diesel) in MW-6 (4.2 mg/l) and MW-7 (6.6 mg/l) detected during the third quarter (April 1992). All other results were either below the detection limits for TPH or below the regulatory guidelines established for TPH in groundwater.

Detected concentrations were consistently lower during the fourth quarterly sampling event compared to the third quarterly results. Sampling rounds previous to the third quarter all showed non-detectable levels. The change in analytical methods used for the third and fourth quarters may have impacted the non-detect levels measured previously. The reduction in concentration of TPH in groundwater between the third and fourth quarters suggests that natural biodegradation and adsorption processes are removing TPH (diesel and gasoline) from groundwater.

Laboratory provided detection limits using analytical EPA method 8015 (used during first and second quarter analyses) were 2.0 mg/L for TPH. Washington State method WTPH-D and WTPH-G (used during third and fourth quarter) provides detection limits of 0.25 mg/L. Any concentration over that detection limit would be detectable.

## 3.6.2 Benzene Concentrations

Benzene has been detected in MW-2, MW-3, and MW-4 above regulatory limits over the entire four quarters. Average concentration for benzene over the four quarters and previous samples in affected wells is as follows: MW-2 (89 ug/L); MW-3 (616 ug/L); and, MW-4 (2950 ug/L). These average concentrations are above MTCA Method A ground-water cleanup guideline for benzene (5 ug/L).

The fourth quarter sample (August 1992) for benzene indicated an increase relative to third quarterly results (April 1992) in monitoring wells MW-2 (94 ug/L), MW-3 (910 ug/L), and MW-4 (3,400 ug/L).

Benzene concentrations are above regulatory limits in three wells (MW-2, MW-3, and MW-4) located near the former UST site. Benzene has not been present in wells located downgradient and toward the

7100 Second Avenue S.W.

Duwamish Waterway (MW-5 and MW-6), and has not been detected in MW-1 which is upgradient of the other wells on site. Levels of benzene have been detected in MW-7 located downgradient of MW-4, MW-3, and MW-2, but are below MTCA guidelines.

These results indicate that while benzene is present in concentrations above regulatory limits near the former UST location, the concentration of benzene is not increasing nor is benzene rapidly mobilizing from close proximity to the former UST location. This is further evidenced by the lack of benzene in downgradient wells close to the Duwamish Waterway indicating that benzene apparently is not migrating at a rapid rate.

Benzene concentrations probably fluctuate due to tidal influences (within the same order of magnitude) over the quarterly sampling period. Additionally, benzene has a relatively high solubility compared to other gasoline constituents, which may account for its relatively high concentration in groundwater.

## 3.6.3 Other Gasoline Constituent Concentrations

During the fourth quarterly sampling event (August 1992) toluene, ethylbenzene, and xylene were detected in MW-3, MW-4, and MW-7. Concentrations during the fourth quarter ranged between 3.2 to 22 ug/L for toluene, ethylbenzene 4.6 to 9.4 ug/L, and xylene 15 to 19 ug/L. Concentrations during the fourth quarter were below the MTCA Method A cleanup guidelines for toluene (40 ug/L), ethylbenzene (30 ug/L), and xylene (20 ug/L).

Toluene, ethylbenzene and xylene were not detected above the detectable limit in wells MW-1, MW-2, MW-5 and MW-6 during the sampling period November 1990 to August 1992.

Low levels of toluene, ethylbenzene and xylene were detected in wells MW-3, MW-4, and MW-7 (toluene only) in samples collected prior to the fourth quarter. Two compounds, toluene and xylene were detected at concentrations above the MTCA Method A cleanup level of 40 and 20 ug/L, respectively during September 1991 in MW-7 (79 ug/L of toluene); December 1990 and September 1991 in MW-3 (48.4 ug/L and 25 ug/L of xylene); and, during December 1990 in MW-4 (63 ug/L of xylene). Subsequent concentrations of toluene and xylene in MW-3 and MW-7 dropped to levels below MTCA Method A cleanup guidelines.

During the final three sampling events, analytical results remained below MTCA cleanup guidelines for toluene, ethylbenzene and xylene. Toluene and xylene concentrations decreased over the monitoring period to levels below regulatory guidelines for that compound in groundwater. The low concentrations and reduction in concentrations indicate that natural attenuation processes are acting to reduce hydrocarbon levels in groundwater at the site.

## 4.0 POTENTIAL RISKS TO ENVIRONMENTAL AND HUMAN HEALTH

The potential for elevated levels of TPH and benzene at the site to affect environmental and human health is influenced by two factors; (1) the potential for migration of site groundwater with elevated TPH

and benzene levels into the Duwamish Waterway, and (2) potential public use of ground-water in the site vicinity.

Based on available geologic and ground-water literature, groundwater in the site vicinity is not used for drinking water purposes. The majority of wells drilled in the river valley generally tapped into small isolated pockets of sand and gravel and were subsequently abandoned due to insufficient yield or poor water quality (high salinity) (Liesch et al. 1963; Richardson et al. 1968; Santos and Stoner 1972). Potable water for the public is provided by the City of Seattle system which draws surface water from reservoirs situated in the Cascade Mountains.

Land use in the site vicinity is industrial and the site is entirely paved. Based on these conditions and the relatively low levels of hydrocarbons detected in site groundwater, the human risk attributed to the presence of TPH and benzene in the groundwater is low.

Brackish or salt water often occurs as a wedge beneath fresh surface water in the Duwamish River. Therefore federal water quality standards for the protection of aquatic species are applicable. The marine water chronic value for benzene is 700 ug/L, which is exceeded in samples from MW-3 and MW-4 (910 and 3,400 ug/L, respectively) during the fourth quarter and during previous sampling events. In comparison, the freshwater acute criteria for benzene of 5,300 ug/L is not exceeded by any analytical result. Based on these comparisons, there is a potential for chronic effects to occur due to the exceedence of the marine chronic value for benzene.

#### 5.0 REGULATORY CONCERNS

The quarterly ground-water monitoring effort was undertaking as an independent action in support of earlier removal of USTs and site assessment. The objective was to map the occurrence and extent of residual petroleum hydrocarbons and constituents in groundwater at the site, and to evaluate the potential rate and direction of migration of the contaminants. This action was conducted in accordance with MTCA cleanup regulation which provides clean-up standards (Method A) for petroleum constituents in groundwater. The following conclusions address regulatory clean-up guidelines and exposure risks associated with hazardous substances in groundwater:

- MTCA Method A cleanup levels are exceeded for benzene and diesel for groundwater beneath the
  site. Concentrations of xylene and toluene have decreased to concentrations below Method A cleanup guidelines in groundwater since the beginning of the monitoring program, indicating natural
  processes are acting to attenuate hydrocarbon constituents in groundwater on site.
- Since the sources of residual petroleum components is removed and the site is covered by hard surfaces, the Duwamish Waterway is the only potential receptor (receiving water) for residual benzene and residual diesel contamination of groundwater. The ecological risk resulting from ground-water discharge into the Duwamish is unknown, however low ground-water flow velocities, absence of a source, and potential dispersion, biodegradation and volatilization are all factors which can attenuate the hydrocarbon contaminants as it drains toward the Duwamish.

 Risk to ecological health could occur resulting from ground-water discharge into the Duwamish, however there does not appear to be an immediate risk to ecology or human health due to the contaminated groundwater beneath the site.

### 6.0 SUMMARY AND RECOMMENDATIONS

## Summary

A summary of findings are listed below:

- Diesel and gasoline were detected in groundwater, with associated benzene, toluene, ethylbenzene
  and xylene; diesel and benzene levels were above MTCA Method A cleanup guidelines;
- The contamination source appears to be from diesel and gasoline tanks, which have been removed;
- Benzene and other soluble compounds have dissolved in the groundwater, accounting for their high
  concentrations; benzene has the highest solubility relative to toluene, xylene, and ethylbenzene which
  accounts for the high concentration of this compound;
- · Potential migration pathway is groundwater flow;
- Flow direction across the site is affected by tides in the Duwamish Waterway;
- Ground-water occurrence seems to indicate the presence of a ground-water divide located midway
  across the site near MW-7. Ground-water contour maps indicate flow direction south of MW-7
  flows toward the slip and flow direction north of MW-7 fluctuates toward or away from the
  Duwamish depending upon tidal level;
- Net flow of groundwater is towards the Duwamish Waterway; and,
- Migration of contaminants appears to be slow and contaminant concentrations fluctuate considerably during the monitoring period.

## Recommendations

Under current conditions, no immediate risk to ecology or human health appears to exist due to the contaminated groundwater beneath the site. However, we recognize that a potential risk may occur if the residual benzene and diesel discharges into the Duwamish at present concentrations. We also recognize that natural attenuation processes may be occurring which could act to reduce residual benzene and diesel in the groundwater prior to reaching the Duwamish. Based on these observations, we have developed the following recommendations:

Monitor for diesel and BTEX only in ground-water samples from site wells twice a year;

- Since changes in land use could alter the ground-water conditions prior to natural reduction in
  petroleum residuum, an action plan is recommended. The action plan should include procedures
  to monitor and protect on-site workers from exposure to the residuum during removal of the paving,
  utility trenching, or other potential construction activities;
- Monitoring data and condition reviews (at least annually) should be kept for review by Ecology and site managers.

## 7.0 REFERENCES

- Freeze, R. A. and J.A. Cherry. 1979. Groundwater, Prentice-Hall, Inc.
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- Richardson, D., J. Bingham, R. Madison. 1968. Water resources of King County, Washington: U.S. Geological Survey, Water Supply Paper 1852.
- Santos, J., and J. Stoner. 1972. Physical, chemical and biological aspects of the Duwamish River Estuary, King County, Washington, 1963-1967: U.S. Geological Survey, Water Supply Paper 1873-C.

# TABLE 1 SUMMARY OF WATER LEVEL DATA NOVEMBER 1990 TO AUGUST 1992 7100 Second Avenue Alaska Marine Lines

	WATER LEVEL ELEVATION <sup>2</sup>						
WELL NO.	November 1, 1990	January 15, 1991	January 25, 1991	September 5, 1991	January 10, 1992	April 8, 1992	August 14, 1992
MW-1	87.87	88.70	88.31	88.23	88.73	88.74	88.07
MW-2	88.18	89.08	88.40	88.26	88.82	88.82	88.24
MW-3	87.89	88.75	88.43	88.29	87.81	88.81	88.23
MW-4	88.45	89.31	89.22	89.09	88.92	89.42	88.97
MW-5	N/A	89.57	89.11	N/A <sup>1</sup>	89.48	89.32	88.85
MW-6	N/A	89.66	89.05	N/A <sup>1</sup>	90.93	89.63	89.18
MW-7	N/A	90.50	90.48	90.31	90.42	90.48	90.20
PIER	N/A	87.94	89.25	N/A	90.77	89.57	90.92

N/A Not Analyzed

Well covered with asphalt on 9/5/91

005\M15C\AML4Q.TBL

Water elevations are relative to the site bench mark, which is the yellow-painted obstruction post located west of the voltage transformer on the south side of the site. The site bench mark is assigned an arbitrary elevation of 100.00 feet.

# TABLE 2 GROUND WATER FIELD SAMPLING PARAMETERS FOURTH QUARTERLY SAMPLING EVENT 7100 2nd Avenue Alaska Marine Lines

WELL NO.	DATE	TIME	pH (-log H <sup>+</sup> )	T (°C)	SC (µS)	Well Vol (gal)	Purge Vol (gal)	Method	Remarks
MW-1	8/16/92	16:35	7.05	16.5	2310	4.8	8	BK Pump	poor recovery of water in well
MW-2	8/16/92	11:05	7.29	16.8	1412	4.9	15	BK Pump	black, turbid
MW-3	8/16/92	14:10	7.12	16.6	1737	5	15	BK Pump	yellow, clear
MW-4	8/16/92	15:30	7.00	15.3	1401	5.6	8	BK Pump	black, turbid, poor recovery of water in well
MW-5	8/16/92	09:50	7.70	21.2	3103	1.6	2	BK Pump	black, turbid, poor recovery of water in well
MW-6	8/16/92	12:20	6.83	17.7	4200	1.4	6	BK Pump	black
MW-7	8/16/92	10:10	7.29	18.1	1574	1.6	6	BK Pump	black, turbid, foam on surface

## TABLE 3 SUMMARY OF GROUND-WATER ANALYTICAL DATA 7100 2nd Avenue Alaska Marine Lines

			Analysis								
WELL NO.	DATE	TPH ppm	TPH-D <sup>1</sup> ppm	TPH-G <sup>2</sup> ppm	Benzene ppb	Toluene ppb	Ethylbenzene ppb	Xylenes ppb			
MW1	11/1/90	0.59	NA.	NA	<1.0	<1.0	< 1.0	<1.0			
	12/18/90	NA	NA	NA		NA	NA	NA			
	9/5/91	<10.0	NA	NA	<1.0	<1.0	<1.0	<2.0			
	1/10/92	< 2.0	NA	NA.	<1.0	< 1.0	< 1.0	< 2.0			
	4/9/92	NA	< 0.25	< 0.25	<1.0	<1.0	< 1.0	<2.0			
	8/16/92	NA	< 0.25	< 0.25	<1.0	< 1.0	<1.0	< 2.0			
MW2	11/1/90	0.56	NA	NA	<1.0	<1.0	<1.0	<1.0			
	12/18/90	NA	NA	NA	NA	NA	NA	NA			
	9/5/91	NA	NA	NA	88	< 1.0	<1.0	< 2.0			
	1/10/92	< 2.0	NA	NA	110	<1.0	< 1.0	< 2.0			
	4/9/92	NA	0.58	0.14J <sup>1</sup>	65	<1.0	< 1.0	< 2.0			
	8/16/92	NA	< 0.25	< 0.25	94	< 1.0	<1.0	< 2.0			
MW3	11/1/90	0.33	NA	NA	<1.0	<1.0	1.1	5.3			
, in the second second	12/18/90	NA	NA	NA	420	3.5	13	48.4			
	9/5/91	< 10.0	NA	NA.	630*	3.2	16	25			
	1/10/92	< 2.0	NA	NA.	500*	3.8	14	17			
	4/9/92	NA	< 0.25	$0.72^{1}$	620*	3	9.1	18			
	8/16/92	NA	$0.30^{1}$	$0.31^{1}$	910*	3.2	9.4	15			
MW4	11/1/90	0.27	NA	NA	4200	8.3	2.1	4.2			
	12/18/90	NA	NA	NA	3600	< 50	<50	63			
	9/5/91	< 10.0	NA	NA	2000	12	<1.0	19			
	1/10/92	< 2.0	NA	NA	2700*	11	4.1	17			
	4/9/92	NA	< 0.25	0.15J <sup>1</sup>	1800*	6.2	< 1.0	5.7			
	8/16/92	NA	< 0.25	$0.22J^{1}$	3400*	12	4.6	19			

## TABLE 3 SUMMARY OF GROUND-WATER ANALYTICAL DATA (Cont.)

					Analys	is		
WELL NO.	DATE	TPH ppm	TPH-D <sup>1</sup> ppm	TPH-G <sup>2</sup> ppm	Benzene ppb	Toluene ppb	Ethylbenzene ppb	Xylenes ppb
MW5	11/1/90	NA	NA	NA	NA	NA	NA	NA
	12/18/90	NA	NA	NA	< 5.0	< 5.0	< 5.0	< 5.0
	9/5/91	NA	NA	NA	NA	NA	NA	NA
	1/10/92	< 2.0	NA	NA	<1.0	<1.0	<1.0	< 2.0
	4/9/92	NA	< 0.25	< 0.25	< 1.0	<1.0	<1.0	<2.0
	8/16/92	NA	0.28 <sup>1</sup>	< 0.25	<1.0	<1.0	<1.0	< 2.0
MW6	11/1/90	NA	NA	NA	NA	NA	NA	NA
	12/18/90	NA	NA.	NA	<5.0	< 5.0	< 5.0	< 5.0
	9/5/91	NA	NA	NA	NA	NA	NA	NA
	1/10/92	<2.0	NA	NA.	< 1.0	<1.0	< 1.0	<2.0
	4/9/92	NA	4.21	< 0.25	<1.0	<1.0	< 1.0	< 2.0
	8/16/92	NA	1.1 <sup>1</sup>	< 0.25	<1.0	<1.0	<1.0	<2.0
MW7	11/1/90	NA	NA	NA	NA	NA	NA	NA
	12/18/90	NA	NA	NA	< 5.0	< 5.0	< 5.0	< 5.0
	9/5/91	<10.0	NA	NA	3.4	79	< 1.0	<2.0
	1/10/92	<2.0	NA	NA	1.7	4.2	<1.0	< 2.0
	4/9/92	NA	6.6 <sup>1</sup>	<0.25	1.6	<1.0	<1.0	< 2.0
	8/16/92	NA	0.73 <sup>1</sup>	< 0.25	1.1	22	<1.0	< 2.0
MTCA <sup>2</sup>		1	1	1	5	40	30	20

In the opinion of the laboratory analyst, there was no chromatographic pattern match for diesel or gasoline.

<sup>2</sup> - MTCA - The Model Toxics Control Act Cleanup Regulation, effective February 28, 1991.

J - Indicates an estimated value when result is less than specified detection limit.

This parameter was not detected at a concentration above the detection level indicated in the table.

NA - Not Analyzed

Indicates the initial analysis of the sample was above the linear range of the analytical instrument. The value

shown is the concentration obtained following the required dilution.

ppm - parts per million ppb - parts per billion

Numbers in bold indicate a concentration at or above the MTCA cleanup levels.

# TABLE 4 SUMMARY OF GROUND-WATER QA/QC ANALYTICAL DATA FOURTH QUARTERLY SAMPLING EVENT 7100 Second Avenue Alaska Marine Lines

DUPLICATE WELL	SAMPLING DATE	WELL NO.	ANALYSIS	SAMPLE VALUES	DUPLICATE VALUES
SAMPLES	8/16/92	MW-2	TPH - Diesel	<0.25 ppm	<0.25 ppm

TRIP BLANK	SAMPLING DATE	WELL NO.	ANALYSIS	SAMPLE VALUES	DUPLICATE VALUES
	8/16/92	N/A	Benzene Toluene	<1.0 ppb <1.0 ppb	N/A N/A
			Ethylbenzene	<1.0 ppb	N/A
			Xylenes	<2.0 ppb	N/A
			WTPH - Gasoline	<0.25 ppm	N/A

N/A - Not applicable.

ppm - parts per million

ppb - parts per billion

This parameter w

- This parameter was not detected at a concentration above the detection level indicated in the table.

Table 5
24-hour Period Water Level Elevations
Alaska Marine Lines
7100 2nd Avenue
Seattle, Washington

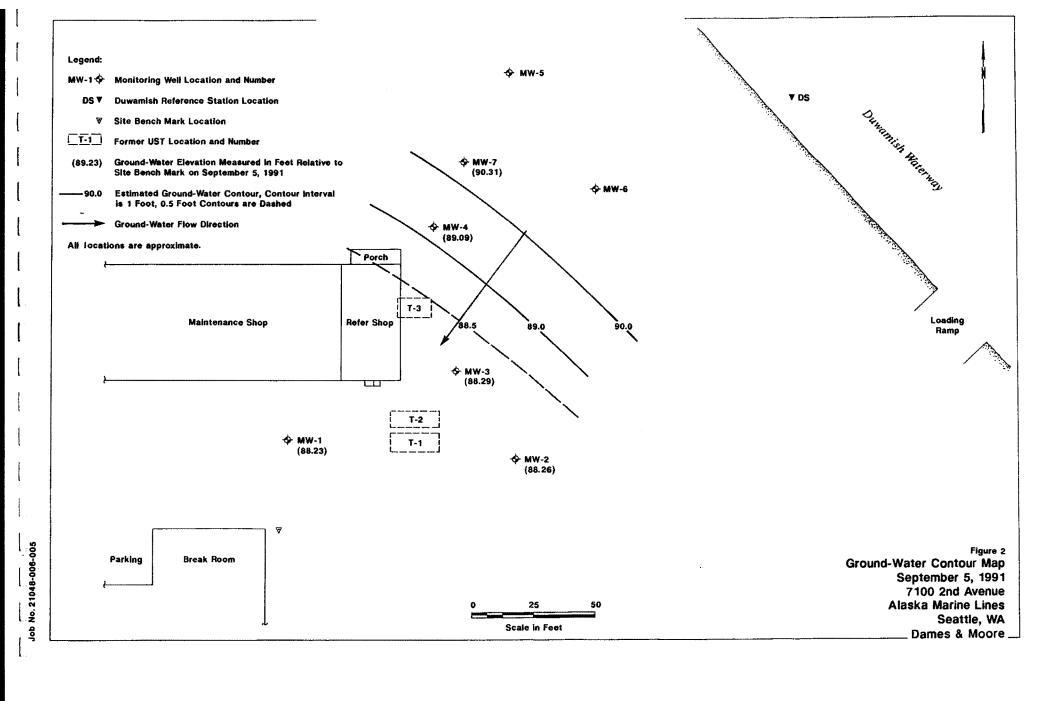
	Time	Station									
		MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	Pier		
14-Aug-92	21:30	88.14	88.31	88.27	88.97	89.00	89.18	89.21	88.92		
_	22:00	88.15	88.33	88.27	88.96	88,98	89.14	89.19	87,92		
	22:30	88.17	88.34	88.28	88.96	88.95	89.10	89.17	87.14		
	23:00	88.17	88.35	88.28	88.96	88.93	89.05	89.15	86.18		
	23:30	88.18	88.36	88.29	88.98	88.91	89.02	89.17	85.4		
5-Aug-92	0:00	88.19	88.35	88.30	88.96	88.89	88.99	89.16	85.04		
	0:30	88.19	88.35	88.29	88.96	88.87	88.96	89.17	84.72		
	1:00	88.19	88.34	88.29	88.96	88.85	88.95	89.17	84.68		
	1:30	88.19	88.33	88.28	88.96	88.83	88.91	89.15	84.8		
	2:00	88.19	88.33	88.28	88.96	88.82	88.91	89.15	85.29		
	2:30	88.18	88.32	88.28	88.96	88.81	88.91	89.15	85.86		
	3:00	88.17	88.31	88.27	88,97	88.80	88.90	89,16	86.52		
	3:30	88.16	88.29	88.26	88.97	88.79	88.90	89,17	87.19		
	4:00	88.16	88.29	88.26	88.97	88.79	88.91	89.17	87.97		
	4:30	88.15	88.28	88.26	88.97	88.80	88,92	89.17	88.84		
	5:00	88.14	88.27	88.26	88.98	88.81	88.94	89.16	89.42		
	5:30	88.14	88.27	88.26	88.98	88.83	88.96	89.17	89.82		
	6:00	88.14	88.27	88.26	88.97	88.84	88.97	89.17	90.07		
	6:30	NA	NA	NA	NA	NA	NA	NA	NA		
	7:00	88.14	88.27	88.26	88.97	88.87	89.01	89.17	89.86		
	7:30	88.14	88.28	88.27	88.96	88.86	89.00	89.17	89.37		
	8:00	88.15	88.28	88.27	88.96	88.86	88.99	89.17	88.77		
	8:30	88.16	88.29	88.28	88.96	88.86	88.97	89.17	88.07		
	9:00	88.17	88.30	88.28	88,95	88.86	88.95	89.17	86.97		
	9:30	88.17	88.30	88.29	88.94	88.84	88.92	89.16	85.91		
	10:00	88.17	88.30	88.28	88.94	88.82	88.88	89.14	84.62		
	10:30	88.17	88.30	88.28	88,93	88.79	88.84	89.14	83.52		
	11:00	88.17	88.30	88.27	88.93	88.76	88.81	89.14	82.57		
	11:30	88.17	88.30	88.27	88.93	88.73	88.79	89.14	81.37		
	12:00	88.16	88.29	88.26	88.94	88.71	88.78	89.15	80.97		
	12:30	88.14	88.27	88.25	88.93	88.68	88.76	89.14	80.92		
	13:00	88.13	88.27	88.24	88.94	88.66	88.76	89.15	80.97		
	13:30	88.12	88.25	88.23	88.95	88.65	88.76	89.15	81.52		
	14:00	88.10	88.24	88.21	88.96	88.64	88.77	89.16	82.22		
	14:30	88.10	88.24	88.21	88.97	88.64	88.77	89.16	83.04		
	15:00	88.09	88.22	88.21	88.97	88.65	88.79	89.17	84.22		
	15:30	88.07	88.21	88.20	88.99	88.68	88,81	89.17	85.27		
	16:00	88.06	88.21	88.20	89.01	88.69	88.84	89.17	86.42		
	16:30	88.06	88.21	88.20	89.02	88.72	88.87	89.18	87.67		
	17:00	88.06	88.20	88.20	89.02	88.72	88.89	89.19	88.87		
	17:30	88.06	88.20	88.21	89.03	88.76	88.93	89.19	89.87		
	18:00	88.06	88.20	88.22	89.04	88.80	88.97	89.20	90.64		
	18:30	88.06	88.20	88.23	89.04	88.84	89.01	89.20	91.20		
	19:00	88,07	88.23	88.24	89.04	88.87	89.05	89.20	91.42		
	19:30	88.08	88.24	88.26	89.04	88.90	89.12	89.21	91.37		
	20:00	88.10	88.25	88.26	89.03	88.93	89.15	89.21	91.15		
	20:30	88.13	88.27	88.26	89.02	88,94	89.17	89.21	90.72		
	21:00	88.13	88.28	88.27	89.02	88.96	89.19	89.20	90.18		

Notes:

Water elevations are relative to site bench mark. Site bench mark is assigned an arbitrary elevation of 100.00 feet.



Source: USGS Topographic Map, 7.5 Minute Quadrangle, Seattle South, 1949. Figure 1
1949 Site Location Map
Alaska Marine Lines
7100 2nd Avenue
Seattle, WA
Dames & Moore



no. 21048-U01-0US

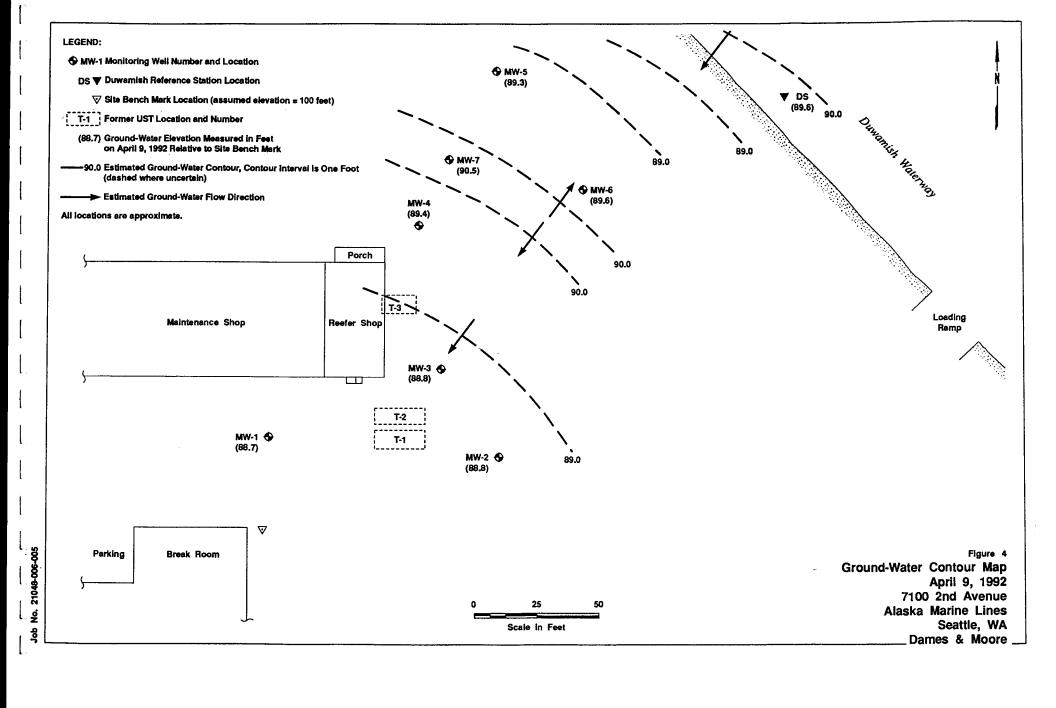
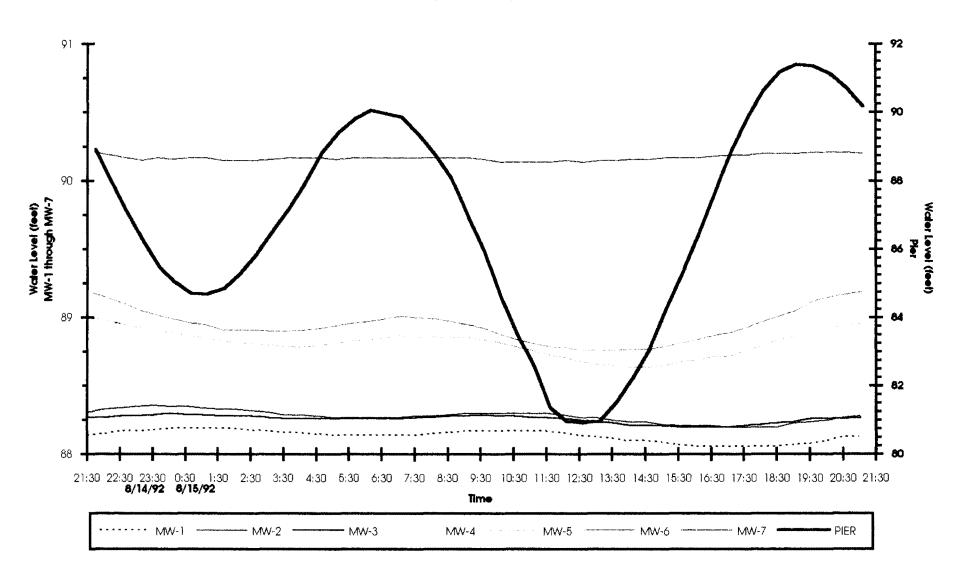


Figure 6 Alaska Marine Lines Water Level (MW1 - 7 & Pier) 8/14 - 8/15/92



Job No. 21048-006-005 (gdl 10/30/92 (AML-WTR.XLW)WTRLVL,XLS Chart 1) 21049\_08.CDR

## APPENDIX A GROUND-WATER SAMPLING DATA FOR FIRST, SECOND, AND THIRD QUARTERLY SAMPLING EVENTS

# TABLE 1 GROUND-WATER SAMPLING DATA THIRD QUARTERLY SAMPLING EVENT 7100 2nd Avenue Alaska Marine Lines

WELL NO.	DATE	TIME	pH (-log H*)	T (°C)	SC (µS)	Well Vol (mV)	Purge Vol (gal)	Method	Remarks
MW1	4/09/92	08:38	7.35	13.3	-23.6	5.8	18	BK Pump	slight hydrocarbon odor; H <sub>2</sub> S odor
MW2	4/09/92	08:47	7.38	13.4	-24.8	6.4	18	BK Pump	strong H <sub>2</sub> S odor
MW3	4/09/92	08:30	7.93	13.2	-52.3	6.5	18	BK Pump	strong hydrocarbon odor; H <sub>2</sub> S odor
MW4	4/09/92	10:22	7.75	12.0	-42.5	1.5	18	BK Pump	distinct hydrocarbon odor
MW5	4/09/92	10:10	8.02	11.7	-59.0	1.7	5	BK Pump	Poor recovery of water in well; H <sub>2</sub> S odor
MW6	4/09/92	09:05	7.32	12.8	-19.6	1.5	5	BK Pump	Poor recovery of water in well; no odor
MW7	4/09/92	09;25	7.55	11.4	-30.3	2.0	5	BK Pump	Poor recovery of water in well; no odor

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# TABLE 1 GROUND-WATER SAMPLING DATA SECOND QUARTERLY SAMPLING EVENT 7100 2nd Avenue Alaska Marine Lines

و تعرب للرب في عرب بليس الله في المول المول

WELL NO.	DATE	TIME	pH (-log H )	T (°C)	SC (µS)	Well Vol (gal)	Purge Vol (gal)	Method	Remarks
MW1	1/10/92	08:30	7.10	51.7	2920	5.3	15	BK Pump	yellowish brown color
MW2	1/10/92	08:15	6.76	56.2	1603	5.3	15	BK Pump	sulfur odor
MW3	1/10/92	08:50	6.83	51.7	1925	4.8	15	BK Pump	strong hydrocarbon odor
MW4	1/10/92	09:00	6.84	51.5	1598	5.9	12	BK Pump	strong hydrocarbon odor, grey color
MW5	1/10/92	11:00	7.07	51.6	1890	6.4	5	BK Pump	very silty, black color, no odor
MW6	1/10/92	10:05	6.70	54.1	4880	7.2	13	BK Pump	sulfur odor, black color, very silty
MW7	1/10/92	09:30	6.73	52.5	1633	6.5	12	BK Pump	lots of mud in well

## TABLE 1 GROUND-WATER SAMPLING DATA 7100 2nd Avenue Alaska Marine Lines

WELL NO.	DATE	TIME	pH (-log H <sup>+</sup> )	T (°C)	SC (µS)	Well Vol (gal)	Purge Vol (gal)	Method	Remarks
MW1	9/5/91	16:00	7.97	17.9	3090	5.1	15.5	bail	yellow, brown color to H D
MW2	9/5/91	11:50	7.49	17.5	1591	5.1	18	bail	not noted
MW3	9/5/91	15:05	7.94	17.7	2070	5.2	18	bail	yellow, very silty
MW4	9/5/91	13:47	7.51	17.2	1647	6.0	18	bail	strong hydrocarbon odor, slightly silty
MW5	9/5/91								not sampled
MW6	9/5/91								not sampled
MW7	9/5/91	16:47	7.30	18.0	1152	1.6	5	bail	sludge laden H <sub>2</sub> 0 fills space between monument and top of casing

## APPENDIX B ANALYTICAL LABORATORY REPORTS

19 September 1991



DAMES & MOORE SEATTLE SEP 2 0 1991 ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sue Kent Dames & Moore 500 Market Place Tower 2025 First Avenue Seattle, WA 98121

RE: Client Project: 21048 006 5052 005; ARI Job #8994

Dear Sue:

Please find enclosed the results for the above referenced project.

If you have any questions or require additional information, please feel free to call any time.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kafe Stepemort

Kate Stegemoeller Project Coordinator

KAS/kp

**Enclosures** 

cc: ARI file #8994



### ORGANICS ANALYSIS DATA SHEET - Method 602/8020 BETX by GC-PID

Matrix: Water Level: Low QC Report No: 8994-Dames & Moore Project No: 21048 006 5052 005

Date Received: 9/5/91

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490

(206) 621-6490 (206) 621-7523 (FAX)

Data Release Authorized: Dam B. Jatha. Report prepared: 9/18/91 - MAC:K kas

	:		Method	MW1-	MW1-	MW2-	MW3-
		Sample No.	Blank	90591	90591	90591	90591
	:	ARI ID	0909MB	8994A	8994Adup	8994B	8994C
		Date Analyzed	09/09/91	09/09/91	09/09/91	09/09/91	09/09/91
		Amt Analyzed	5.0 mls				
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	1.0 U	88	310 X
108-88-3	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	3.2
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U	1.0 U	16
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U	2.0 U	25

**Surrogate Recoveries** 

Trifluorotoluene	97.6%	98.9%	94.6%	94.9%	93.8%
Bromobenzene	98.0%	102%	96.7%	94.7%	100%

			MW4-	MW7-	Trip
		Sample No.	90591	90591	Blank
		ARI ID	8994D	8994E	8994F
		Date Analyzed	09/09/91	09/09/91	09/10/91
		Amt Analyzed	5.0 mls	5.0 mls	5.0 mls
CAS Num	ber	Units	μg/L	μg/L	μg/L
71-43-2	Benzene		560 X	3.4	1.0 U
108-88-3	Toluene		12	79	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		19	2.0 U	2.0 U

**Surrogate Recoveries** 

Trifluorotoluene	76.9%	92.6%	87.0%
Bromobenzene	91.8%	94.8%	89.0%

#### **Data Reporting Qualifiers**

Value If the result is a value greater than or equal to the detection limit, report the value.

B This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.



## **BETX by GC-PID**

Matrix: Water Level: Low

QC Report No: 8994-Dames & Moore Project No: 21048 006 5052 005

**ORGANICS ANALYSIS DATA SHEET - Method 602/8020** 

Date Received: 9/5/91

**ANALYTICAL RESOURCES INCORPORATED** 

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Data Release Authorized: 1/mm/5. Report prepared: 9/18/91 - MAC:K kas

			Method	MW3-	MW4-	MW7-
		Sample No.	Blank	90591 di	90591 dl	90591 re
		ARI ID	0911MB	8994Cdl	8994Ddl	8994Ere
		Date Analyzed	09/11/91	09/12/91	09/12/91	09/12/91
		Amt Analyzed	5.0 mls	0.1 mls	0.1 mls	5.0 mls
CAS Num	nber	Units	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	670	2000	2.0
108-88-3	Toluene		1.0 U	50 U	50 U	70
100-41-4	Ethylbenzene		1.0 U	50 U	50 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	100 U	100 U	2.0 U

**Surrogate Recoveries** 

Trifluorotoluene	102%	53.1%	107%	105%	
Bromobenzene	102%	56.7%	95.0%	99.2%	ĺ

		Sample No.	Method Blank	MW3- 90591 dl2
	ļ	ARI ID	0917MB	8994Cdl2
		Date Analyzed	09/17/91	09/17/91
		Amt Analyzed	5.0 mls	0.1 mls
CAS Num	ber	Units	μg/L	μg/L
71-43-2	Benzene		1.0 U	590
108-88-3	Toluene		1.0 U	50 U
100-41-4	Ethylbenzene		1.0 U	50 U
1330-20-7	Total Xylenes		2.0 U	100 U

**Surrogate Recoveries** 

Trifluorotoluene	98.6%	95.0%
Bromobenzene	97.9%	94.8%

#### **Data Reporting Qualifiers**

Value If the result is a value greater than or equal to the detection limit, report the value.

This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.



#### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

## TOTAL PETROLEUM HYDROCARBONS BY GC/FID Modified EPA Method 8015

Matrix: Waters

Project: 21048 006 5052 005

QC Report No: 8994-Dames & Moore

Data Release Authorized Clary /. //cww VTSR: 09/05/91

Report Prepared: 9/13/91 - MAC:K kas

Date Extracted:

09/10/91

Date Analyzed:

09/11/91

Surr. Recovery

Lab ID	Client Sample ID	TPH (ppm)	Pattern ID	Gas.	Diesel
8994 MB	Method Blank	10 U	==4000	78.6%	95.1%
8994 A	MW1-090591	10 U		122%	185%
8994 B	MW2-090591	10 U	****	80.0%	98.8%
8994 C	MW3-090591	10 U	W + + + + + + +	87.9%	110%
8994 D	MW4-090591	10 U		94.7%	107%
8994 E	MW7-090591	10 U		73.0%	107%

U Indicates compound was analyzed for but not detected at the given detection limit.

Gasoline surrogate: Bromobenzene Diesel surrogate: Me-arachidate

### DAMES & MOORE

Chain of Custody

Date 9 / 5 / 91 Page \_\_\_ of \_\_\_

500 Market Place Tower • 2025 First Avenue • Seattle, Washington 98121 • (206) 728-0744

Project Number: 21048 006 5052 005 **Analysis Request** Project Manager: Suc Kont Laboratory: ART
Tum around time: 2 www. Polycyclic Aromatic Hydrocarbons 610/8310 Number of Containers Haiogenated Volatiles 601/8010 xinteM Volatile Organics 624/8240 (GC/MS) Base/Neutral/Acids 625/8270 (GC/MS) Aromatic Volatiles 602/8020 Pesticides/PCBs 608/8080 Priority Pollutant Metals (13) EP TOX Metals (8) Comments/ BTX 602/8015 Sampler's Initials: IMW Sampler's Signature: Tuwilliam, Instructions Sample ID Date Time 1/5/9/16/5 3 MWI -090591 3 MW2-090521 1200 3 MW3- 090591 1520 3 X 1415 3 1700 # none Trip Blank 11 Sample Receipt Relinquished by: Received by (lab): Special Instructions/Comments: (Sig) Dawes Moore
(Company) Dawes Moore
(Time) 1805 (Date) (Date) Total no. of containers Chain of custody seals: Rec'd good condition/cold: Conforms to record: Lab number:

A.R.I# 8994

22 January 1992



ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Sue Kent Dames & Moore 500 Market Place Tower 2025 First Avenue Seattle, WA 98121

RE: Client Project: #21048-006

ARI Job #9777

Dear Sue:

Please find enclosed the results and original chain-of-custody report for the above referenced project. Samples arrived in good condition on 1/10/92, and analyses proceeded without incident.

Samples MW-3 and MW-4 contained high levels of benzene, so the samples were diluted and re-analyzed. Both the initial and diluted results are included.

If you have any questions or need further information, please feel free to call any time. I can be reached at the number above, or direct at 340-2867, ext. 117, where you can also leave a message if I'm not available.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kate Stegemoeller Project Coordinator

DAMES & MOORE SEATTLE

JAN 23 1992

KAS/ks

**Enclosures** 

cc: file#9777



#### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North

Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

Consultants

Matrix: Water Level: Low

**BETX by GC-PID** 

QC Report No: 9777-Dames &

Moore

748-UUY

Project No: 21048-006 Date Received: 1/10/92

Report prepared:	1/22/92 - MAC:K kas	
	i	Method

ORGANICS ANALYSIS DATA SHEET - Method 602/8020

			Method				MW-3
		Sample No.	Blank	MW-1	MW-2	MW-3	duplicate
		ARI ID	MB01/14	9777A	9777B	9777C	9777Cdup
		Date Analyzed	01/14/92	01/15/92	01/15/92	01/15/92	01/15/92
		Amt Analyzed	5.0 mls				
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	110	320 X	320 X
108-88-3	Toluene		1.0 U	1.0 U	1.0 U	3.8	3.8
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U	14	14
1330-20-7	Total Xylenes		2.0 U	2.0 ∪	2.0 U	17	17

**Surrogate Recoveries** 

Trifluorotoluene	93.9%	91.4%	102%	91.2%	92.7%	
Bromobenzene	85.1%	89.8%	104%	100%	102%	

		Sample No.	MW-4	MW-6	MW-7	MW-1dup	RB-011092
		ARI ID	9777D	9777F	9777G	9777H	97771
		Date Analyzed	01/15/92	01/15/92	01/15/92	01/15/92	01/15/92
		Amt Analyzed	5.0 mls				
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		630 X	1.0 U	1.7	1.0 U	1.0 U
108-88-3	Toluene		11	1.0 U	4.2	1.0 U	1.0 U
100-41-4	Ethylbenzene		4.1	1.0 U	1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		17	2.0 U	2.0 U	2.0 U	2.0 U

**Surrogate Recoveries** 

Trifluorotoluene	91.2%	88.9%	80.1%	89.5%	82.4%
Bromobenzene	95.0%	83.9%	78.3%	85.6%	77.1%

#### **Data Reporting Qualifiers**

Value If the result is a value greater than or equal to the detection limit, report the value.

- B This flag is used when the analyte is found in the blank as well as a sample. Indicates possible/probable blank contamination.
- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when result is less than specified detection limit.



#### **ANALYTICAL** RESOURCES **INCORPORATED**

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-7523 (FAX)

QC Report No: 9777-Dames & (206) 621-6490

Project No: 21048-006

Moore Date Received: 1/10/92

Matrix: Water Level: Low

BETX by GC-PID

Data Release Authorized: \_\_\_\_\_\_\_ Report prepared: 1/22/92 - MAC:K kas

ORGANICS ANALYSIS DATA SHEET - Method 602/8020

		[	Trip	Method		MW-3
		Sample No.	Blank	Blank	MW-5	dilution
		ARI ID	97 <b>7</b> 7J	MB01/15	9777Ere	9777C 25X
		Date Analyzed	01/15/92	01/15/92	01/15/92	01/15/92
		Amt Analyzed	5.0 mls	5.0 mls	5.0 mls	0.2 mls
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	1.0 U	500
108-88-3	Toluene		1.0 U	1.0 U	1.0 U	25 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U	25 U
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U	50 U

**Surrogate Recoveries** 

Trifluorotoluene	83.6%	86.7%	96.7%	99.1%
Bromobenzene	78.4%	76.8%	103%	97.6%

			MW-3	MW-4
		Sample No.	dup. dilution	dilution
		ARI ID	9777Cdup 25X	9777D 50X
		Date Analyzed	01/15/92	01/15/92
	•	Amt Analyzed	0.2 mls	0.1 mls
CAS Num	ber	Units	μg/L	μg/L
71-43-2	Benzene		450	2700
108-88-3	Toluene		25 U	50 U
1	Ethylbenzene		25 U	50 U
1330-20-7	Total Xylenes		50 U	100 U

**Surrogate Recoveries** 

Trifluorotoluene	89.0%	94.7%
Bromobenzene	85.3%	85.7%

#### **Data Reporting Qualifiers**

Value If the result is a value greater than or equal to the detection limit, report the value.

- В This flag is used when the analyte is f in the blank as well as a sample. Ind possible/probable blank contaminal
- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when I is less than specified detection limit.



## TOTAL PETROLEUM HYDROCARBONS WA HCID Method by GC/FID

#### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

QC Report No: 9777-Dames & Moore

Project: 21048-006

VTSR: 01/10/92

Matrix: Water

Data Release Authorized

Data Prepared: 1/14/92 - MAC: RPR

Date extracted: 01/13/92 Dates Analyzed: 01/13/92

			Dilution	Petroleum		Surrogate	
Lab ID		Client Sample ID	Factor	Hydrocarbons †	TPH ID *	Recovery	
MB	0103	Method Blank	-	2.0 U	*	88.4%	
9777	Α	MW - 1	-	2.0 U	No	130%	
9777	В	MW - 2	-	2.0 U	No	98.2%	
9777	С	MW - 3	-	2.0 U	No	79.9%	
9777	D	MW - 4	-	2.0 U	No	98.4%	
9777	E	MW - 5	-	2.0 U	No	99.5%	
9777	F	MW - 6	-	2.0 U	No	98.5%	
9777	G	MW - 7	-	2.0 U	No	93.6%	
9777	Н	MW - 1 DUP	1 -	2.0 U	No	87.6%	
9777	ı	RB - 011092	-	2.0 U	No	128%	

Surrogate is Me-Arachidate.

Values reported in ppm (mg/L).

- U Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- \* In the opinion of the analyst, was there a pattern match for diesel or gasoline (yes or no).
- † Value based on total peaks in the range from Toluene to C24.

### **Chain of Custody**

500 Market Place Tower • 2025 First Avenue • Seattle, Washington 98121 • (206) 728-0744

Date / / /٥ / 92 Page / of /

Project Number: 21048-006						Analysis Request														
Project Number:  Sue Kent  Laboratory:  ARI  Turn around time:  Regular		cs MS)	olatiles	lles	cids MS)		natic 610/8310	38	5 -HC 10				Jt.	ø		Comments/	ntainers			
Sampler's Initials: SJM Sampler's Signature: SUM				Volatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Aromatic Volatiles 602/8020	Base/Neutral/Acids 625/8270 (GC/MS)	BTX 602/8015	Polycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8080	TPH-805	BETX			Priority Pollutant Metals (13)	EP TOX Metals (8)		Instructions	Number of Containers	
Sample ID	D	ate	Time	Matrix	Vols 624	8 H	Aro 602	Bas 625	KTB	일 분	8 8 8	7	8			Prio Met	₩ €			+
MW-1	1/1	0/92	10:45	HZD	<u> </u>							/	<u></u>							3
MW-2	Ļ	<u> </u>	12:40		ļ							V	V							3
Mω- 3			10:00	Ц_								V	V							3
MW-4			11:20									/	/							3
MW-5			14:10									1	1							3
MW- 10			14:45		<u> </u>							/	1							3
Mw-7			12:00									/	/	,						3
MW-1 Dup.			10:45									/	1							3
RB-011092		<u> </u>	11:45									/	1							3
Trip Blank	11	7/92		1																,
•	Ļ	<i>'</i>											ļ							
			<u></u>																	
										<u> </u>										
															<u> </u>					
Special Instructions/C	omn	nents	<b>:</b> :		Reli	nquish	ed by:					Rece	eived b	y (lab	):			Sa	ample Receip	t
(Sig) Beath				,	1/Cial A R. VVLI CYY III'a .					Total no. of containers	-									
(Printed) Scott J. Mickelson					1	(Prin	ted)	She	Pn 0	mi	Mer	 C	chain of custody seals	-						
					(Cor	npany	Dar	nes E	Ma	ے.		(Company), A.R.I.						'd good condition/cold		
					(Tim	(Printed) Scott J. Mickelson (Printed) Shelby Miller Rec'd good condition (Company) Dames & More (Company) A.R.I. Conforms to re (Time) 15:19 (Date) 1/10/92 (Lab number: Q.D.)						umber: OD >								
<u> </u>															1			 Lavi	ampor 4.111	1

23 April 1992



DAMES & MOORE SEATTLE

APR 24 1992

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Ingrid Williams Dames & Moore 500 Market Place Tower 2025 First Avenue Seattle, WA 98121

RE: Client Project: Alaska Marine Lines ARI Job #A420

Dear Ingrid:

Please find enclosed the results and original chain-of-custody records for the above referenced project. Nine samples were received in good condition on 4/9/92.

BETX samples MW-3 and MW-4 required re-analysis at dilution due to levels of benzene above the instrument calibration range. Values for all the runs are reported here. The analyst notes that diesel samples MW-6, MWX-6, and MW-7 appear to have hydrocarbons in the motor oil range. Analysis by Method 418.1 could be used to achieve more accurate quantitation of these levels.

If you have any questions or need further information, please feel free to call any time.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kate Stegemoeller Project Coordinator 206-340-2867, ext. 117

Kafe SLevenior

KAS/ks

**Enclosures** 

cc: file#A420



#### **ANALYTICAL** RESOURCES **INCORPORATED**

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490

QC Report No: A420-Dames&Mod<sup>26</sup> 621-7523 (FAX)

Project: Alaska Marine Lines

VTSR: 04/09/92

TOTAL DIESEL RANGE HYDROCARBONS WA TPHD Method by GC/FID

Data Release Authorized

Matrix: Waters

Data Prepared: 04/14/92 - MAC:C PA

Date Extracted: 04/10/92 Dates Analyzed: 04/13-14/92

		Dilution	<b>Diesel</b>		Surrogate
Lab ID	Client Sample ID	Factor	Hydrocarbons †	Diesel ID *	Recovery
A420 MB	Method Blank	1	0.25 U	No	106%
A420 A	MW-1	1	0.25 U	No	112%
A420 B	MW-2	1	0.58	Yes	114%
A420 C	MW-3	1	0.25 U	No	106%
A420 D	MW-4	1	0.25 U	No	113%
A420 E	MW-5	1	0.25 U	No	110%
A420 F	MW-6	1	4.2	No	61.3%
A420 G	MWX-6	1	4.6	No	79.4%
A420 H	MW-7	1	6.6	No	93.3%
A420 I	RB-040992	1	0.25 U	No	103%
A420 IDUP	RB-040992 DUPL.	1	0.25 U	No	119%

Surrogate is Me-Arachidate.

Values reported in ppm (mg/L).

- Indicates no value reported due to saturation of the detector.
- Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- In the opinion of the analyst, was there a pattern match for diesel.
- † Value based on total peaks in the range from C12 to C24.



## TOTAL GASOLINE RANGE HYDROCARBONS BY GC/FID WA TPH-G Method (Purge & Trap)

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

QC Report No: A420-Dames & Moore

Project: Alaska Marine Lines

VTSR: 04/09/92

Matrix: Waters

Data Release Authorized

Data Prepared: 04/23/92 MAC:D sk

Date Analyzed: 04/16,17,20/92

			Dilution	Gasoline Range		Surrogate	Surrogate	
Lab	ID	Client Sample ID	Factor	Hydrocarbons †	Gas ID *	A	В	
A420	MB	Method Blank	NA	0.25 U	No	94.3%	90.2%	
A420	A	MW-1	NA	0.25 U	No	92.9%	91.6%	
A420	С .	MW-3	NA	0.72	No	90.2%	97.7%	
A420	D	MW-4	NA	0.15 J	No	93.0%	96.7%	
A420	D dup	MW-4 dup	NA	0.15 J	No	85.6%	90.0%	
A420	I	RB-040992	NA	0.25 U	No	92.1%	88.4%	
A420	MB	Method Blank	NA	0.25 U	No	95.2%	97.0%	
A420	В	MW-2	NA	0.14 J	No	101%	97.6%	
A420	E	MW-5	NA	0.25 U	No	101%	99.6%	
A420	F	MW-6	NA	0.25 U	No	90.9%	86.2%	
A420	G	MWX-6	NA	0.25 U	No	94.6%	90.9%	
A420	Н	MW-7	NA	0.25 U	No	97.6%	95.5%	

Surrogate A = Trifluorotoluene Surrogate B = Bromobenzene

Values reported in ppm (mg/L).

- U Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- \* In the opinion of the analyst, was there a pattern match for gasoline (yes or no).
- † Value based on total peaks in Toluene-C12 range.
- J Indicates an estimated value when result is less than specified detection limit.



#### **ANALYTICAL RESOURCES INCORPORATED**

Analytical

Project No: Alaska Marine Lines

QC Report No: A420-Dames & Moore

VTSR: 4/9/92

Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187

(206) 621-6490 (206) 621-7523 (FAX)

### ORGANICS ANALYSIS DATA SHEET BETX by Method 602/8020

Matrix: Water Level: Low

Data Release Authorized: Report prepared: 04/22/92 - MAC: RPR

Instrumen	t ID: GC/PID	Sample No.	Method Blk	Method Blk	Method Blk	MW-1	MW-2
		ARI ID	MB 0415	MB 0416	MB 0420	A420 - A	A420 - B
		Date Analyzed	4/15/92	4/16/92	4/20/92	4/16/92	4/16/92
		Amt Analyzed	5.0 ml	5.0 ml	5.0 ml	5.0 ml	5.0 ml
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	1.0 U	1.0 U	65
108-88-3	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
		Trifluorotoluene	105%	89.5%	78.3%	97.1%	94.4%
		Bromobenzene	102%	94.3%	80.0%	98.5%	95.6%

				T T		1	
Instrumen	it ID: GC/PID	Sample No.	M W - 3	M W - 3	M W - 4	M W - 4 dup	MW-4dl
		ARI ID	A420 - C	A420 - C dl	A420 - D	A420 - D Dup	A420 - D dl
		Date Analyzed	4/16/92	4/20/92	4/16/92	4/16/92	4/22/92
		Amt Analyzed	5.0 ml	0.5 ml	5.0 ml	5.0 ml	0.1 ml
CAS Num	ber	Units	μg/L	μg/L	μg/L	μg/L	μg/L
71-43-2	Benzene		220 X	620	370 X	370 X	1800
108-88-3	Toluene		3.0	10 U	6.2	6.0	50 U
100-41-4	Ethylbenzene		9.1	10 U	1.0 U	1.0 U	50 U
1330-20-7	Total Xylenes		18	20 U	5.7	5.1	100 U
		Trifluorotoluene	93.5%	97.5%	96.4%	88.9%	91.6%
		Bromobenzene	105%	98.1%	102%	94.8%	96.7%

### GC DATA QUALIFIERS

- U Indicates the compound was undetected at the listed concentration.
- Indicates an estimated value when the value is less than the calculated detection limit.
- Indicates the surrogate(s) was not detected, due to dilution of extract.
- NR Indicates the surrogate recovery cannot be reported due to matrix interference.
- Indicates a value above the linear range of the detector. Dilution required.
- Indicates no value reported due to saturation of the detector. Dilution required.
- Indicates a probable value which is unable to be confirmed due to matrix interference



Project No: Alaska Marine Lines

QC Report No: A420-Dames & Moore

VTSR: 4/9/92

#### **ANALYTICAL** RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

### **ORGANICS ANALYSIS DATA SHEET** BETX by Method 602/8020

Matrix: Water

Data Release Authorized:

Level:

Report prepared: 04/22/92 - MAC: RPI

Low

Instrumen	t ID: GC/PID	Sample No.	M W - 5	M W - 6
		ARI ID	A420 - E	A420 - F
		Date Analyzed	4/17/92	4/17/92
		Amt Analyzed	5.0 ml	5.0 ml
<b>CAS Num</b>	ber	Units	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U
108-88-3	Toluene		1.0 U	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	2.0 U
		Trifluorotoluene	93.1%	83.9%
		Bromobenzene	96.2%	85.0%

Instrumen	t ID: GC/PID	Sample No.	MWX-6	M W - 7	RB-040992
		ARI ID	A420 - G	A420 - H	A420 - I
		Date Analyzed	4/17/92	4/17/92	4/16/92
		Amt Analyzed	5.0 ml	5.0 ml	5.0 ml
CAS Num	ber	Units	μg/L	μg/L	μg/L
71-43-2	Benzene		1.00	1.6	1.0 U
108-88-3	Toluene		1.0 U	1.0 U	1.0 U
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 U
		Trifluorotoluene	85.8%	89.3%	86.3%
		Bromobenzene	87.6%	92.1%	90.9%

#### GC DATA QUALIFIERS

- U Indicates the compound was undetected at the listed concentration.
- Indicates an estimated value when the value is less than the calculated detection limit.
- Indicates the surrogate(s) was not detected, due to dilution of extract.
- NR Indicates the surrogate recovery cannot be reported due to matrix interference.
- Indicates a value above the linear range of the detector. Dilution required. Х
- S Indicates no value reported due to saturation of the detector. Dilution required.
- Indicates a probable value which is unable to be confirmed due to matrix interference

# Chain of Custody Record & **Laboratory Analysis Request**



ΈD

ANALYTICAL
RESOURCES
INCORPORATE

ARI Client: Dames & Moore Phone #: 728-0744

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Clien	t Contact: Ingria	( Wil	ham	<b>პ</b>						Anal	/sis Req	uired				Notes/Comments
Clien	t Project ID: Alas	ka 1	<i>Morin</i>	e Li	nes		- 4	-6	P							
Samp	olers: Scott M	icke	lson	1			K		,							
	Sample ID	Date	Time	Matx	No Cont	Lab ID	BKTX	8015	8015	-						
1	MW-1	4/9/92	1530	H20	3	A420-A	1	V	/							
2	MW-2		1500		1	B	1	/	/							
3	MW-3		1105			C	V	/	/							
4	MW-4		1135			D	/	1	/	~.u.ut.baa.						
5	MW-5		1300			E	/	/	V							
6	MW-6		1345			F	/	/	/	-						
7	MWX-4		B45			6	/	/	/	•						Field Duplicate
8	MW-7	1	1220	4	>	W H	/	/	/							·
Com	ments/Special Instructi	ons:	Relinc	uished	car	Mi		Relina (Signa	quished	by:				Relina (Signa	quished	d by:
	44, 184		Printe	d Name	e. /	elson			d Nam	e:					d Nan	ne:
			Comp	oany:	FM			Com	oany:					Com	pany:	
	Date: Time: 1630					Date:			Time:			Date:		Time:		
Received by: (Signature)				Felker			ived by ature)	<b>/</b> :	*******			Rece (Signa	ived b ature)	y:		
Printed Name (VAN Fell III)				^		d Nam	e:					d Nan	ne:			
Company: ART.					Com	oany:					Company:					
Date: 4/9/92 Time: 16/3				30	Date: Time:			Date: Time:								

# Chain of Custody Record & Laboratory Analysis Request

Date: 4/9/92

2



RESOURCES INCORPORATED

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

ARI C	Client: Dames &	28-8744	Number of coolers:							(206) 621-6490 (206) 621-7523 (FAX)						
Clien	t Contact: Ingric	1 Will	lam	<u>క</u>						Anal	ysis Rec	uired				Notes/Comments
Clien	t Project ID: Alak	a Mo	rine		<u> క</u>		7	4	9			٠				
Samp	olers: Scott Mick	relsa	7	·			BETY	80154	8015-0							
	Sample ID	Date	Time	Matx	No Cont	Lab ID	8	38	80							
_1_	RB-040992	4/9/92	1315	H20	з	A420-I	1	1								Rinseate Blank
2																,
3						,								·		,
4			-													
5						·						•				
6																
7																
8						,										
Com	ments/Special Instructi	ions:	Relina (Signa	quished ature)	LOU	him			quishec ature)	l by:					quished ature)	d by:
			Printe Sc	d Nam	Ni Ce	elson		Printe	ed Nam	e:				Printe	ed Nan	ne:
			<u> </u>		)	100re		Com	pany:					Com	pany:	
			Date:	4/9/9	2	Time:	)	Date			Time			Date	:	Time:
			Recei (Signo	ived by	2	Filk			ived by	<b>/</b> :			·		lved b ature)	y:
				d Now	And		ins		ed Nam	ie:					ed Nan	ne:
			Comp	pany:	9.K	ZI.		Com	pany:			4.0		Com	pany:	
			Date:	4/9	192	Time: 16/	30	Date			Time		***************************************	Date		Time:

27 August 1992



DAMES & MOORE SEATTLE AUG 2 8 1992

ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

Ingrid Williams
Dames & Moore
500 Market Place Tower
2025 First Avenue
Seattle, WA 98121

RE: Client Project: 21048-006-005 Alaska Marine / 7100 2nd Av SW Site ARI Job #8501

Dear Ingrid:

Please find enclosed the results and original chain-of-custody record for the above referenced project. Seven water samples and a trip blank were received in good condition on 8/17/92, and the analyses proceeded without incident. A duplicate was analyzed for each parameter as per your instructions on the 18th.

BETX samples MW-3 and MW-4 required re-analysis at diluted levels due to benzene concentrations above the linear range of the detector. Results of both the undiluted and diluted analyses are reported.

Samples MW-5 and MW-6 appear to contain hydrocarbons eluting later than the diesel range, which is why they were not positively identified on either the gas or diesel report forms. Sample MW-7 contains some benzene and toluene, with peaks later than diesel range, also. I've enclosed the chromatograms for all samples and a diesel standard for your examination.

A copy of this package and all raw data will be kept on file should you need additional information at a future date. Also, if you have any questions, please feel free to call any time.

Sincerely,

ANALYTICAL RESOURCES, INC.

Kate Stegemoeller Project Coordinator 206-340-2866, ext. 117

Late Selema

**Enclosures** 

cc: file#B501



# **Chain of Custody**

500 Market Place Tower • 2025 First Avenue • Seattle, Washington 98121 • (206) 728-0744

Date 8 /17 / 92 Page / of /

Project Number: 2	Project Number: 21048-006-00 Project Manager: Inacid williamo							Analysis Request														
Project Manager: Laboratory: — Turn around time: —	<u> </u>	!		<u> </u>		SS MS)	olatiles	les	cids MS)		natic 610/8310	şş		_			<b>1</b>	ø			Comments/	ntainers
Sampler's Initials: - Sampler's Signature:	53 Sc.	M	J		,,	Votatile Organics 624/8240 (GC/MS)	Halogenated Volatiles 601/8010	Aromatic Volatiles 602/8020	Base/Neutral/Acids 625/8270 (GC/MS)	BTX 602/8015	Polycyclic Aromatic Hydrocarbons 610/8310	Pesticides/PCBs 608/8080	WTPH-G	9-10-13			Priority Pollutant Metals (13)	EP TOX Metals (8)			Instructions	Number of Containers
Sample ID	D	ate	Time	Ma	atrix	Vola 624/	8 Had	Aror 602/	Bas 625/	XT8	F Poly	P 808	3	5			Prio Met	8 ⊞				
Mw-1	7/11	0/92	16:50	1+2	<u>.</u> O					/			V	/								4
MW-2		<u></u>	11:50							/			/	/								4
Μω-3			14:45							/			/	/								4
MW-4			17:00							/				/				<u></u>				4
MW-5			13:55							/			/	1								4
MW-6			15:50							/			1	/								4
MW-7	7	/	10:45	,	/					V			V	/								4
Trip Blank	-			Hz	0					1			~									2
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	<u>L</u>			<u> </u>	· · · · · · · · · · · · · · · · · · ·	Delle		<b></b>	<u></u>				Base		(1-1-	\.	<u> </u>			0	ample Recei	nt
Special Instructions/Co			•			Helin	quish	ea by:	1.				Hece	eived b	y (lab	): 	,	~				<del>-</del>
Alaska Marine L	ine	<b>5</b>				(Sig)	Self	Mu	1			·	(Sig)	Le	u_	Z)	le	en a		1	Total no. of containe	
7100 and Ave 5	س	Si	te-					Scott	J. 1	Micke	ulson		(Prin	ted)_C	TAI	4/	Q//	Lee	4	ſ	Chain of custody sea	<b>—</b>
						(Con	npany)	Dan	<u> ۱ دی ک</u>	Moor	<u>e_</u>		(Con	npany)	D	Ri-	Z.			Hed	c'd good condition/co Conforms to reco	
						(Time	e)_ <i>[</i> 7	: 35		. (Date	e) <b>8/</b> 1-	1/92-	(Time	e/ 7	35	Ri-	_(Dat	<b>\$1</b> 7	pz	Lab n	number:	



#### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

QC Report No: B501-Dames&Moore

Project: 21048-006-005

Alaska Marine

VTSR: 08/17/92

TOTAL GASOLINE RANGE HYDROCARBONS WA TPHG Method by GC/FID

Matrix: Water

Data Release Authorized\_

Data Prepared: 08/24/92 - MAC: A pr

Date Extracted: 08/18/92 Date Analyzed: 8/18 - 19/92

			Dilution	Gasoline Range		Surrogate	Surrogate
La	b ID	Client Sample ID	Factor	Hydrocarbons †	Gas ID *	A	В
B501	MB0818	Method Blank	-	0.25 U	_	97.9%	102%
B501	MB0819	Method Blank	-	0.25 U	No	84.5%	84.9%
B501	Α	M W - 1	-	0.25 U	No	92.9%	99.5%
B501	В	M W - 2	-	0.25 U	No	92.3%	97.9%
B501	С	M W - 3	-	0.31	No	92.7%	101%
B501	D	M W - 4	-	0.22 J	No	93.3%	101%
B501	E	MW-5	-	0.25 U	No	85.6%	87.3%
B501	F	M W - 6	-	0.25 U	No	82.2%	84.0%
B501	G	MW-7	-	0.25 U	No	86.2%	88.9%
B501	Н	TRIP BLANK	1 -	0.25 U	No	95.9%	93.3%

Surrogate A = Trifluorotoluene Surrogate B = Bromobenzene

Values reported in ppm (mg/L).

- U Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- \* In the opinion of the analyst, was there a pattern match for gasoline.
- † Value based on total peaks in the range from Toluene to Dodecane.



**ANALYTICAL RESOURCES** INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

### **ORGANICS ANALYSIS DATA SHEET BETX by Method 602/8020**

Matrix: Water

Level: Low

Data Release Authorized:

Report prepared: 08/24/92 - MAC: A rpr

Project No: 21048-006-005 Alaska Marine 7100 2nd Ave. SW QC Report No: B501-Dames & Moore

VTSR: 8/17/92

Instrumer	t ID: GC/PID	Sample No.	Method Blk	MW-1	MW-2
		ARI ID	MB-0818	B501 - A	B501 - B
		Date Analyzed	8/18/92	8/19/92	8/19/92
		Amt Analyzed	5.0 ml	5.0 ml	5.0 ml
CAS Num	ber	Units	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	94
108-88-3	Toluene		1.0 U	1.0 U	1.0 U
100-41-4	Ethylbenzene		1.00	1.0 U	1.0 U
1330-20-7	Total Xylenes	:	2.0 U	2.0 U	2.0 U
		Trifluorotoluene	99.1%	93.2%	93.0%
		Bromobenzene	97.9%	90.5%	89.9%

Instrumen	t ID: GC/PID	Sample No.	M W - 3	MW-4	Trip Blank
		ARI ID	B501 - C	B501 - D	B501 - H
		Date Analyzed	8/18/92	8/19/92	8/19/92
		Amt Analyzed	5.0 ml	5.0 ml	5.0 ml
CAS Num	ber	Units	μg/L	μg/L	μg/L
71-43-2	Benzene		380 X	790 X	1.0 U
108-88-3	Toluene		3.2	12	1.0 U
100-41-4	Ethylbenzene		9.4	4.6	1.0 U
1330-20-7	Total Xylenes		15	19	2.0 U
		Trifluorotoluene	90.4%	89.1%	94.7%
		Bromobenzene	94.1%	94.1%	91.3%

#### GC DATA QUALIFIERS

- U Indicates the compound was undetected at the listed concentration.
- Indicates an estimated value when the value is less than the calculated detection limit,
- Indicates the surrogate(s) was not detected, due to dilution of extract.
- NR Indicates the surrogate recovery cannot be reported due to matrix interference.
- Indicates a value above the linear range of the detector. Dilution required.
- Indicates no value reported due to saturation of the detector. Dilution required.
- Indicates a probable value which is unable to be confirmed due to matrix Interference



Project No: 21048-006-005

Alaska Marine 7100 2nd Ave. SW

VTSR: 8/17/92

QC Report No: B501-Dames & Moore

#### ANALYTICAL RESOURCES **INCORPORATED**

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

### **ORGANICS ANALYSIS DATA SHEET BETX by Method 602/8020**

Matrix: Water

Level:

Data Release Authorized:

Report prepared: 08/24/92 - MAC: A rpr

Instrumen	t ID: GC/PID	Sample No.	Method Blk	M W - 3	M W - 4
		ARI ID	MB-0818	B501 - C	B501 - D
		Date Analyzed	8/19/92	8/19/92	8/19/92
		Amt Analyzed	5.0 ml	0.1 ml	0.05 ml
CAS Num	ber	Units	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	910	3400
108-88-3	Toluene		1.0 U	50 U	100 U
100-41-4	Ethylbenzene		1.0 U	50 U	100 U
1330-20-7	Total Xylenes		2.0 U	1 <b>0</b> 0 U	200 U
<b>L</b>		Trifluorotoluene	104%	110%	110%
		Bromobenzene	101%	107%	106%

Instrument ID: GC/PID		Sample No.	M W - 5	M W - 6	MW-7
		ARI ID	B501 - E	B501 - F	B501 - G
		Date Analyzed	8/19/92	8/19/92	8/19/92
		Amt Analyzed	5.0 ml	5.0 ml	5.0 ml
CAS Number		Units	μg/L	μg/L	μg/L
71-43-2	Benzene		1.0 U	1.0 U	1.1
108-88-3	Toluene		1.0 U	1.0 U	22
100-41-4	Ethylbenzene		1.0 U	1.0 U	1.0 U
1330-20-7	Total Xylenes		2.0 U	2.0 U	2.0 ∪
		Trifluorotoluene	105%	101%	104%
		Bromobenzene	102%	98.1%	103%

### GC DATA QUALIFIERS

- Indicates the compound was undetected at the listed concentration.
- Indicates an estimated value when the value is less than the calculated detection limit,
- Indicates the surrogate(s) was not detected, due to dilution of extract.
- NR Indicates the surrogate recovery cannot be reported due to matrix interference.
- Χ Indicates a value above the linear range of the detector. Dilution required.
- Indicates no value reported due to saturation of the detector. Dilution required,
- C Indicates a probable value which is unable to be confirmed due to matrix interference



# TOTAL DIESEL RANGE HYDROCARBONS WA TPHD Method by GC/FID

#### ANALYTICAL RESOURCES INCORPORATED

Analytical Chemists & Consultants

333 Ninth Ave. North Seattle, WA 98109-5187 (206) 621-6490 (206) 621-7523 (FAX)

QC Report No: B501-Dames & Moore

Project: Alaska Marine

VTSR: 08/17/92

Data Release Authorized

Matrix: Water

Data Prepared: 08/26/92 - MAC:C pat

Date Extracted: 08/18/92 Date Analyzed: 08/21-22/92

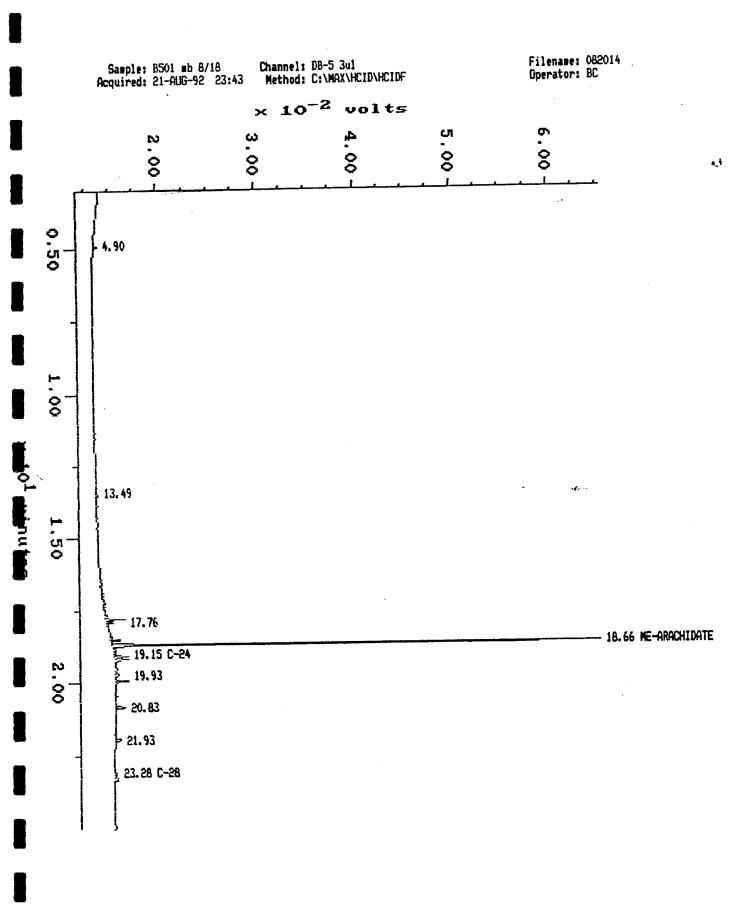
		Dilution	Diesel Range		Surrogate
Lab ID	Client Sample ID	Factor	Hydrocarbons †	Diesel ID *	Recovery
B501 MB	Method Blank	1	0.25 U	No	84.5%
B501 A	MW-1	1	0.25 U	No	77.0%
B501 B	MW-2	1	0.25 U	No	79.5%
B501 BDUP	MW-2 DUPL.	1	0.25 U	No	83.4%
B501 C	MW-3	1	0.30	No	69.3%
B501 D	MW-4	1	0.25 U	No	78.1%
B501 E	MW-5	1	0.28	No	85.1%
B501 F	MW-6	1	1.1	No	79.5%
B501 G	MW-7	1	0.73	No	82.3%

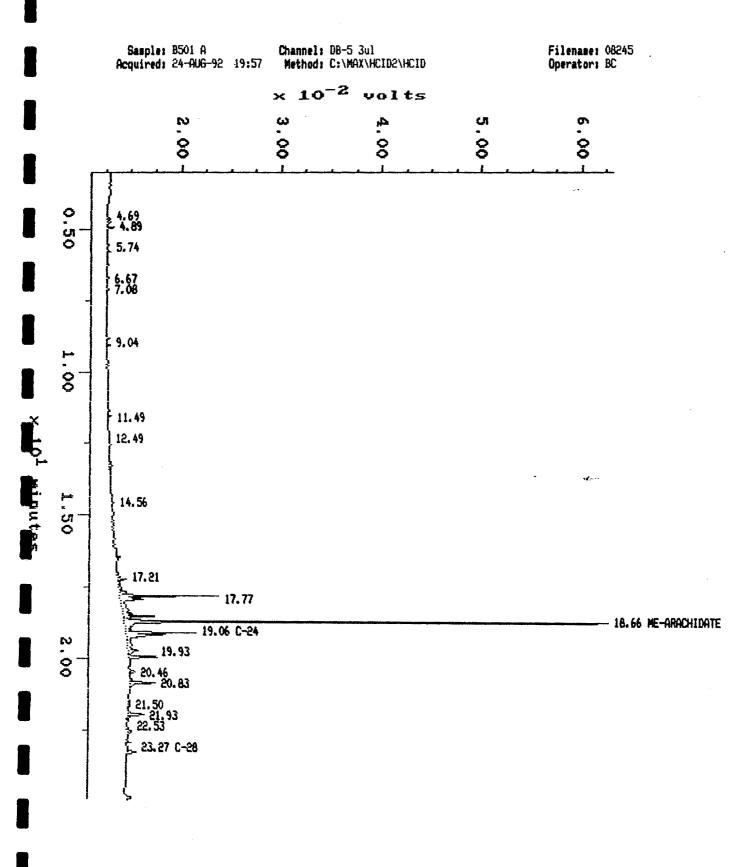
Surrogate is Me-Arachidate.

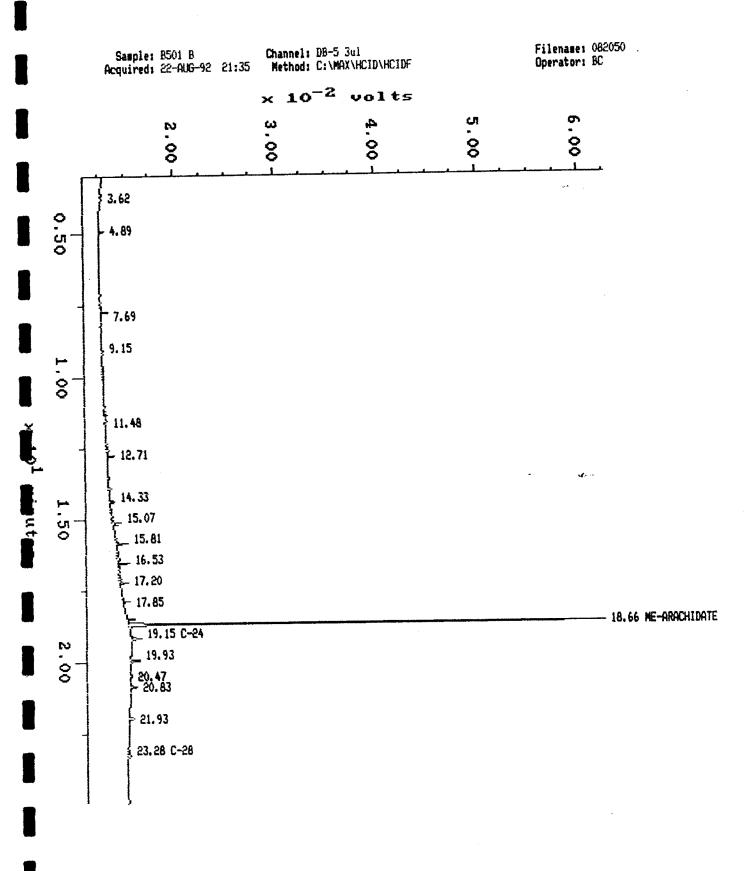
Values reported in ppm (mg/kg).

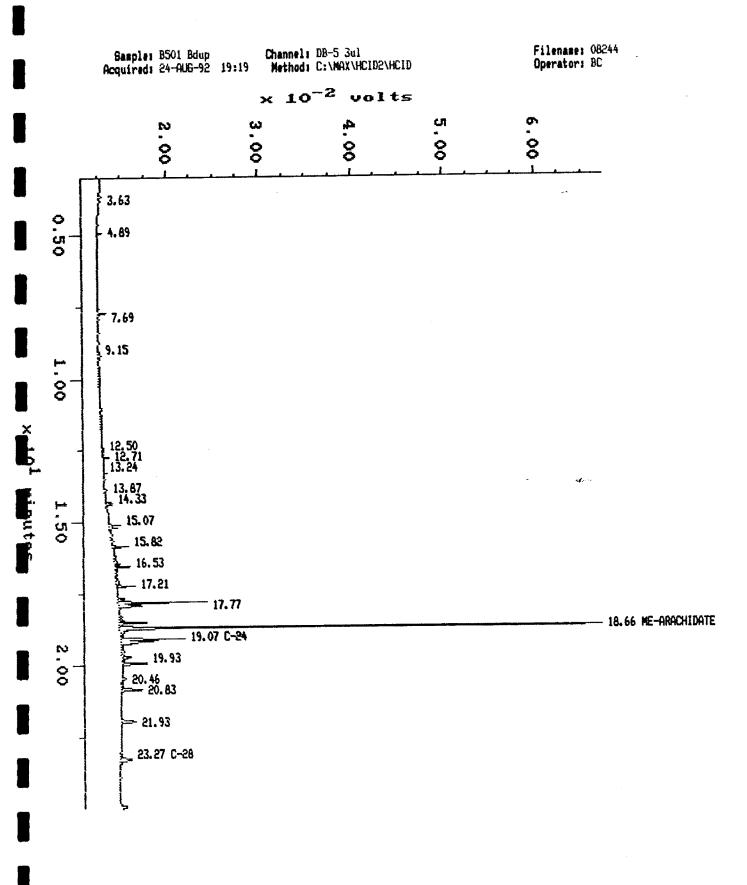
- U Indicates compound was analyzed for but not detected at the given detection limit.
- X Indicates a value above the linear range of the detector. Dilution required.
- \* In the opinion of the analyst, was there a pattern match for diesel.
- † Value based on total peaks in range from C12-C24.

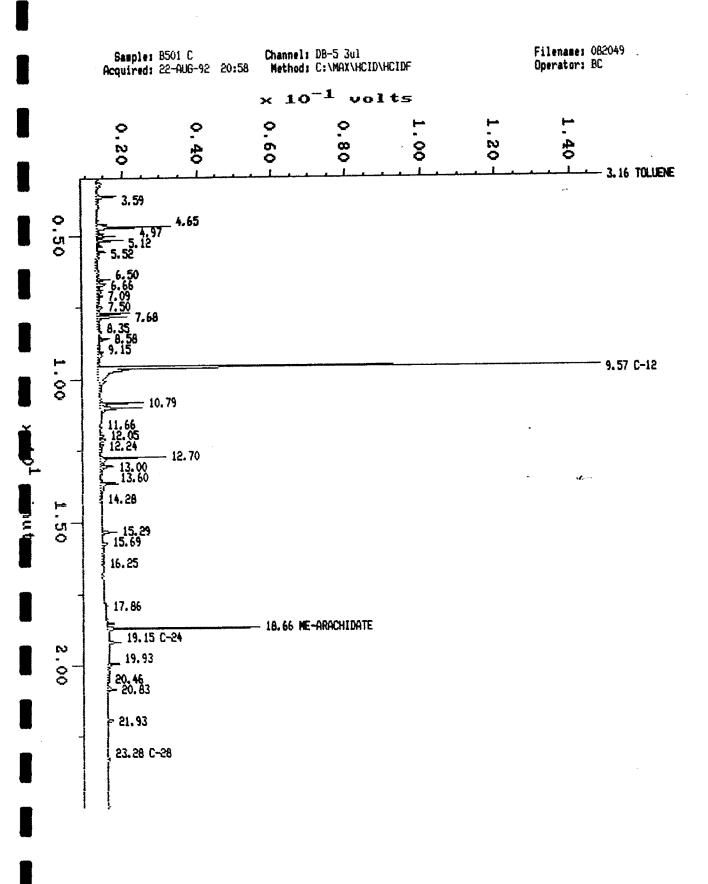
Filename: 08203 Sample: DIESEL 250 Channel: DB-5 3ul Acquired: 21-RUG-92 17:03 Method: C:\MAX\HCID\HCIDF Operator: BC  $\times$   $10^{-2}$  volts 4.00 6.00 - 3.17 TOLUENE 3.82 0.50 4.48 5.14 - 5.64 6.18 BROMOBENZENE 6.63 - 7.47 - 7.98 - 8.45 1.00 - 9.61 C-12 10.68 **=** 11.19 12.06 - 12.58 - 13.08 - 13.46 - 13.87 14.64 15.39 15.62 1.50 A Mount \_ 16.41 \_ 17.21 - 17.86 \_\_\_\_ 18.66 ME-ARACHIDATE 19.16 C-24 19.93 20.43 20.81 23, 12 23.89

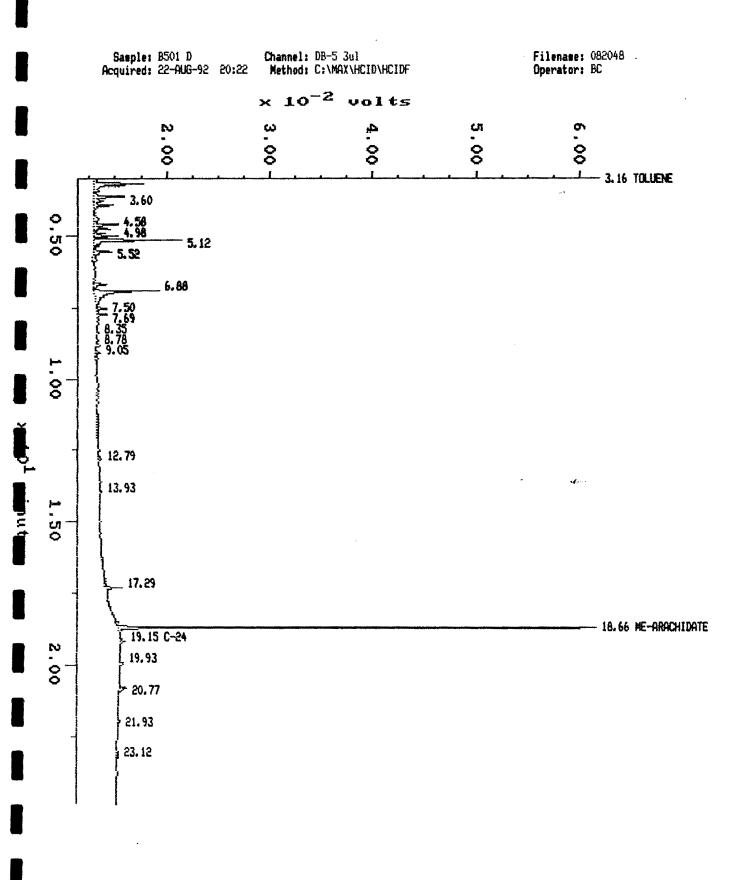


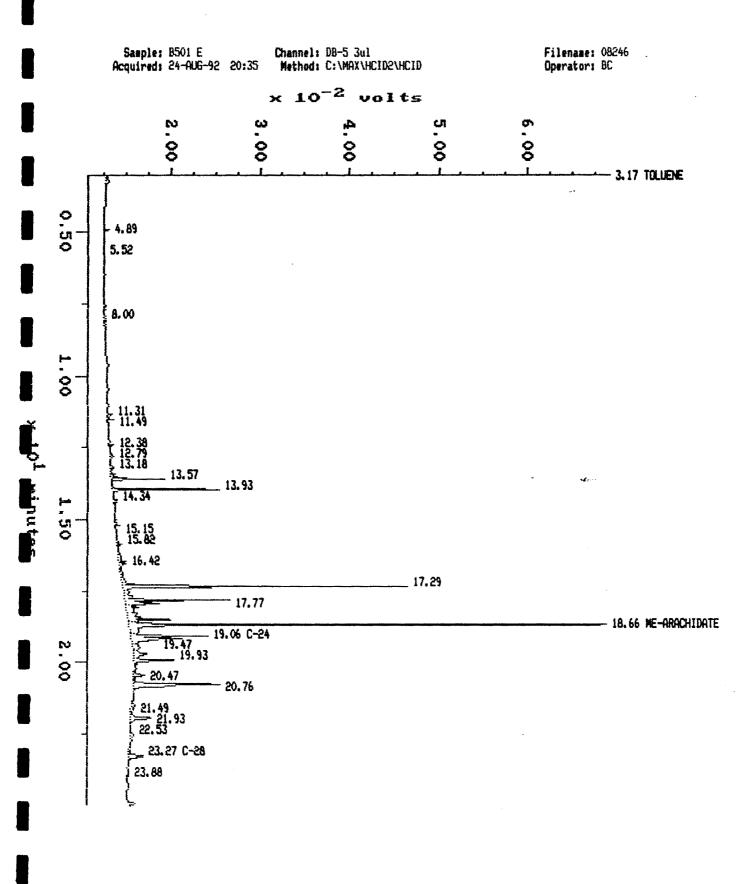




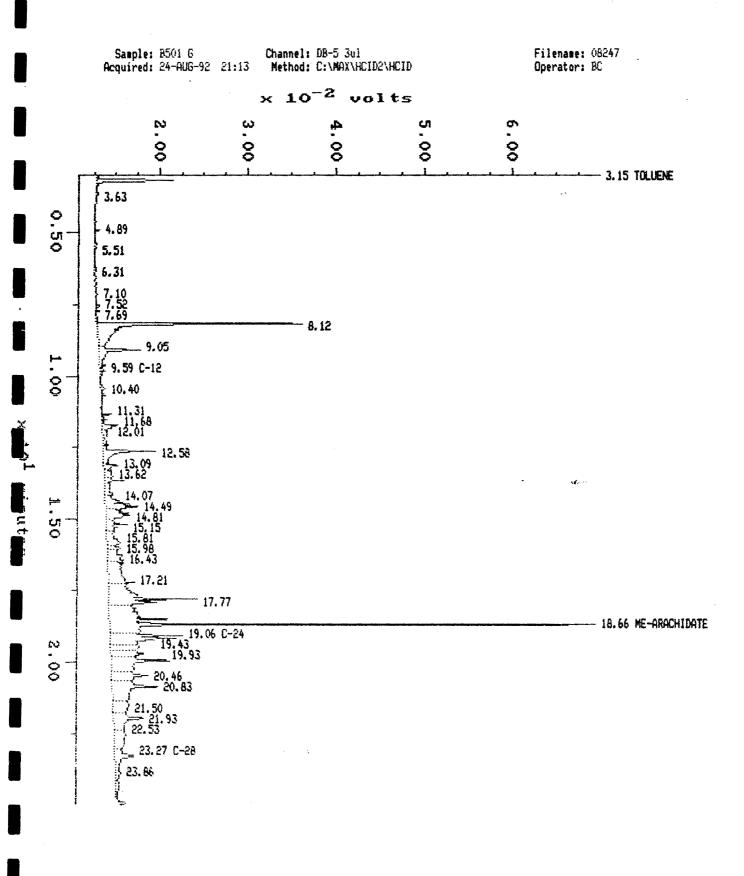








Sample: B501 F Channel: DB-5 3ul Acquired: 24-AUG-92 21:51 Method: C:\MAX\HCID2\HCID Filename: 08248 Operator: BC × 10<sup>-2</sup> volts 2. 00 4.89 7.08 9.04 11.67 16.53 17.21 ----- 18.66 ME-ARACHIDATE 19.15 C-24 19.42 19.93 20.23



### APPENDIX C SLUG TEST DATA

7100 Second Avenue S.W.

Dames & Moore 01/9'9 9'040 04440 3,840 3,240 2,640 2,040 1,440 048 Elapsed Time (seconds) 910 360 510 110 98 09 32 81 13 8 ε 0 1.2 0.8 9.0 0.4 0.2 0 (feet) Change in Water Level

MW-1 Rate of Recharge Slug Test Results

Dames & Moore 079'9 070'9 077'7 3,840 3,240 2,640 2,040 1,440 048 910 Elapsed Time (seconds) 360 510 110 28 09 32 8 t 13 8 ε 0 0.8 9.0 0.2 0 0.4 Change in Water Level (feet)

MW-4 Rate of Recharge Slug Test Results

7,200 01999 9,040 077'7 3,840 3,240 2,640 2,040 1,440 840 Elapsed Time (seconds) 910 360 510 110 **98** 09 32 81 13 8 ε 0 1.2 0.8 9.0 0,4 0.2 0 (feet) Change in Water Level

MW-5 Rate of Recharge Slug Test Results

Dames & Moore

MW5.XLC

Dames & Moore 9'640 9'040 4,440 3,840 3,240 2,640 2,040 1,440 048 919 Elapsed Time (seconds) 360 210 110 **68** 09 32 81 ٤t 8 ε 0 0.8 9.0 0.4 0.2 0 (feet) Change in Water Level

MW-6 Rate of Recharge Slug Test Results

# Unit# 00033 Test 0

Setups: I	NPUT 1	INPUT 2
Type I	Level (F)	 Level (F) TOC
	_	0300
Reference	10.450	9.470
Linearity	0.140	0.130
Scale factor Offset	19.870 0.140	20.010 0.070
Delay mSEC	50.00	

# Step 0 08/14 20:16:47

Elapsed Time INPUT 1 IN	YP L	П	L
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0.0000	10.450	9.482	
30.0000	10.513	9.507	
60.0000	10.544	9.514	
90.0000	10.563	9.520	
120.000	10.582	9.520	
150.000	10.601	9.520	
180.000	10.620	9.514	
210.000	10.651	9.514	
240.000	10.664	9.520	
270.000	10.689	9.520	
300.000	10.701	9.520	
330.000	10.720	9.514	
360.000	10.727	9.507	
390.000	10.739	9.507	
420.000	10.745	9.507	
450.000	10.745	9.501	
480.000	10.739	9.495	
510.000	10.727	9.495	
540.000	10.714	9.495	
570.000	10.701	9.495	
600.000	10.695	9.501	
630.000	10.676	9.507	
660,000	10.676	9.507	

690.000	10.676	9.520
720.000	10.676	9.520
750.000	10.683	9.533
780.000	10.695	9.533
810.000	10.720	9.539
840,000	10.745	9.545
870.000	10,771	9.545
900.000	10.796	9.545
930.000	10.821	9.539
960,000	10.846	9.539
990.000	10.865	9.533
1020.00	10.884	9.526
1050.00	10.890	9.520
1080.00	10.896	9.507
1110.00	10.890	9.495
1140.00	10.878	9.482
1170.00	10.865	9.476
1200.00	10.840	9.463
1230.00	10.808	9.450
1260.00	10.783	9,444
1290.00	10.745	9.431
1320.00	10.714	9.431
1350.00	10.676	9.431
1380.00	10.645	9.431
1410.00	10.620	9,438
1440.00	10.594	9.438
1470.00	10.575	9.450
1500.00	10.569	9.463
1530.00	10.563	9.470
1560.00	10.569	9.476
1590.00	10.569	9.489
1620.00	10.582	9.489
1650.00	10.607	9.489
1680.00	10.638	9.495
1710.00	10.651	9.495
1740.00	10.683	9.495
1770.00	10.689	9,489
1800.00	10.708	9.489
1830.00	10.714	9.489
1860.00	10.720	9.482
1890.00	10.720	9.476
1920.00	10.720	9.476
1950.00	10.714	9.470
1980.00	10.695	9.476
2010.00	10.689	9.476
2040.00	10.676	9.482
2070.00	10,070	7.702

2070.00	10.664	9.482
2100.00	10.651	9.489
2130.00	10.645	9.489
2160.00	10.632	9.489
2190.00	10.632	9.495
2220.00	22.996	20.437

### Unit# 00033 Test 1

Setups: I	NPUT 1
Mode	Level (F) TOC 0150
Reference	9.560
Linearity	0.140
Scale factor	19.870
Offset	0.140
Delay mSEC	50.000

# Step 0 08/16 09:56:03

Elapsed	Time	INPUT	1
---------	------	-------	---

0.0000	5.781
0.0033	5.787
0.0066	5.787
0.0100	5.774
0.0133	5.818
0.0166	5.799
0.0200	5.806
0.0233	5.799
0.0266	5.718
0.0300	5.604
0.0333	6.133
0.0500	5.844
0.0666	5.850
0.0833	5.963
0.1000	5.957
0.1166	5.894
0.1333	5.831
0.1500	6.121
0.1666	6.115
0.1833	5.951
0.2000	5.963
0.2166	5.862
0.2333	6.007

0.0500	£ 00£
0.2500	5.995
0.2666	6.007
0.2833	6.020
0.3000	6.026
0.3166	6.039
0.3333	6.052
0.4166	6.096
0.5000	6.146
0.5833	6.190
0.6666	6.222
0.7500	6.259
0.8333	6.297
0.9166	6.322
1.0000	6.354
1.0833	6.385
1.1666	6.404
1.2500	6.436
1.3333	6.455
1.4166	6.480
1.5000	6.505
1.5833	6.530
1.6666	6.549
1.7500	6.574
1.8333	6.593
1.9166	6.612
2.0000	6.631
2.5000	6.745
3.0000	6.845
3.5000	6.934
4.0000	7.015
4,5000	7.091
5.0000	7.160
5.5000	7.230
- 6.0000	7.286
6.5000	7.343
7.0000	7.393
7.5000	7.450
8.0000	7.494
8.5000	7.538
9.0000	7.582
9.5000	7.620
10.0000	7.664
12.0000	7.809
14.0000	7.929
16.0000	8.030
- 18.0000	8.118
- 10,0000	0,110

20.0000	8.256
22.0000	8.344
24.0000	8.414
26.0000	8.489
28.0000	8.540
30.0000	8.590
32.0000	8.653
34.0000	8.703
36.0000	8.747
38.0000	8.785
40.0000	8.817
42.0000	8.842
44.0000	8.880
46.0000	8.911
48.0000	8.943
50.0000	8.968
52.0000	8.999
54.0000	9.031
56.0000	9.050
58.0000	9.081
60.0000	9.087
62.0000	9.125
64.0000	9.150
66.0000	9.169
68.0000	9.188
70.0000	9.213
72.0000	9.232
74.0000	9.257
76.0000	9.257
78.0000	9.289
80.0000	9.301
82,0000	9.320
84.0000	9.333
86.0000	9.352
88.0000	9.352
90.0000	9.383
	9.390
92.0000	9.390
94.0000	
96.0000	9.402
98.0000	9.402
100.000	9.421
110.000	9.490
120.000	9.528
130.000	9.566

### Unit# 00033 Test 2

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	00150
Reference	9.630
Linearity	0.140
Scale factor	19.870
Offset	0.140
Delay mSEO	50.000

# Step 0 08/16 12:17:41

Elapsed Time	INPUT
0.0000	9.214
0.0033	9.239
0.0066	9.233
0.0100	9.208
0.0133	9.202
0.0166	9.214
0.0200	9.221
0.0233	9.183
0.0266	9.265
0.0300	9.252
0.0333	9.271
0.0500	9.145
0.0666	9.227
0.0833	9.353
0.1000	9.076
0.1166	9.082
0.1333	9.120
0.1500	9.139
0.1666	9.158
0.1833	9.164
0.2000	9.170
0.2166	9.183
0.2333	9.195

0.2500	9.208
0.2666	9.214
0.2833	9.221
0.3000	9.063
0.3166	9.170
0.3333	9.202
0.4166	9.233
0.5000	9.258
0.5833	9.265
0.6666	9.277
0.7500	9.290
0.8333	9,296
0.9166	9.302
1.0000	9.315
1.0833	9.321
1.1666	9.327
1.2500	9.334
1.3333	9.346
1.4166	9.346
1.5000	9.353
1.5833	9.359
1.6666	9.365
1.7500	9.372
1.8333	9.372
1.9166	9.378
2.0000	9.378
2.5000	9.403
3.0000	9.416
3.5000	9.434
4.0000	9.447
4.5000	9.460
5.0000	9.478
5.5000	9.478
6.0000	9.491
6.5000	9.497
7.0000	9.504
7.5000	9.510
8.0000	9.510
8.5000	9.516
9.0000	9.516
9.5000	9.523
10.0000	9.523
12.0000	9.548
14.0000	9.554
16.0000	9.554
18.0000	9.560

20.0000	9.560	
22.0000	9.567	
24.0000	9.567	
26.0000	9.567	
28.0000	9.573	
30.0000	9.573	
32.0000	9.573	
34.0000	9.579	
36.0000	9.573	
38.0000	9.579	
40.0000	9.573	
42.0000	9.573	
44.0000	9.579	
46.0000	9.579	
48.0000	9.579	
50.0000	9.585	
52.0000	9.567	
54.0000	9.579	
56.0000	9.579	
58.0000	9.573	

### Unit# 00033 Test 3

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	00150
Reference	9.630
Linearity	0.140
Scale factor	19.870
Offset	0.140
Delay mSEC	50.000

# Step 0 08/16 13:23:25

Elapsed Time	INPUT	1
0.0000	7.414	
0.0033	8.239	
0.0066	7.150	
0.0100	7.710	
0.0133	8.050	
0.0166	8.182	
0.0200	8.358	
0.0233	8.805	
0.0266	8.113	
0.0300	7.509	
0.0333	7.987	
0.0500	8.308	
0.0666	8.610	
0.0833	8.509	
0.1000	8.604	
0.1166	8.522	
0.1333	8.484	
0.1500	8.547	
0.1666	8.560	
0.1833	8.755	
0.2000	8.616	
0.2166	8.472	
0.2333	8.635	

0.2500 0.2666 0.2833	8.717 9.025 8.654
0.3000	8.673
0.3166	8.692
0.3333	8.667
0.4166	8.667
0.5000	8.679
0.5833	8.686
0.6666	8.692
0.7500	8.698
0.8333	8.705
0.9166	8.705
<b>~</b> 1.0000	8.711
1.0833	8.717
1.1666	8.723
1.2500	8.723
1.3333	8.730
1.4166	8.730
1.5000	8.736
1.5833	8.736
1.6666	8.742
1.7500	8.749
1.8333	8.749
1.9166	8.755
2.0000	8.755
2.5000	8.774
3.0000	8.780
3.5000	8.793
4.0000	8.805
4.5000	8.812
5.0000	8.824
5.5000	8.830
<b>6.0000</b>	8.843
6.5000	8.849
7.0000	8.849
7.5000	8.856
8.0000	8.862
8.5000	8.862
9.0000	8.868
9.5000	8.868
10.0000	8.874
12.0000	8.893
14.0000	8.887
16.0000	8.900
18.0000	8.900

	20.0000	8.906
	22.0000	8.906
	24.0000	8.906
	26.0000	8.912
	28.0000	8.919
	30.0000	8.912
	32.0000	8.919
	34.0000	8.919
	36.0000	8.906
	38.0000	8.919
	40.0000	8.919
	42.0000	8.919
	44.0000	8.919
	46.0000	8.925
	48.0000	8.925
	50.0000	8.925
	52.0000	8.925
	54.0000	8.925
	56.0000	8.931
	58.0000	8.925
•	60.0000	8.931
	62.0000	8.931
	64.0000	8.931
	66.0000	8.931
	68.0000	8.931
	70.0000	8.937
	72.0000	8.931
	74.0000	8.937
	76.0000	8.925
	78.0000	8.919
	80.0000	8.937
	82.0000	8.937
	84.0000	8.937
	86.0000	8.937
	88.0000	8.931
	90.0000	8.937
	92.0000	8.931
	94.0000	8.937
	96.0000	8.937
	98.0000	8.937
	100.000	8.937
	110.000	8.931

# Unit# 00033 Test 4

Setups:	INPUT 1
Type	Level (F)
Mode	TOC
I.D.	00150
Reference	10.500
Linearity	0.140
Scale factor	19.870
Offset	0.140
Delay mSE	C 50.000

# Step 0 08/16 15:29:21

Elapsed	Time	INPUT	1

0.0000	8.101
0.0033	8.372
0.0066	8.680
0.0100	8.391
0.0133	8.221
0.0166	8.108
0.0200	7.906
0.0233	8.007
0.0266	8.378
0.0300	8.523
0.0333	8.460
0.0500	8.328
0.0666	8.517
0.0833	8.618
0.1000	8.706
0.1166	8.769
0.1333	8.970
0.1500	8.743
0.1666	8.712
0.1833	8.806
0.2000	9.128
0.2166	8.964
0.2333	9.027

0.2500	9.027
0.2666	9.102
0.2833	9.178
	9.159
0.3000	
0.3166	9.190
0.3333	9.159
0.4166	9.216
0.5000	9.272
0.5833	9.291
0.6666	9.323
0.7500	9.329
0.8333	9.367
0.9166	9.348
1.0000	9.367
1.0833	9.373
1.1666	9.386
1.2500	9.398
1.3333	9.404
1.4166	9.411
1.5000	9.423
1.5833	9.430
1.6666	9.436
1.7500	9.442
1.8333	9,449
1.9166	9.455
2.0000	9.461
2.5000	9,499
3.0000	9.530
3.5000	9.562
4.0000	9.587
4.5000	9.606
5.0000	9.625
5.5000	9.650
6.0000	9.669
6.5000	9.688
7.0000	9.707
7.5000	9.725
8.0000	9.751
8.5000	9.770
9.0000	9.788
9.5000	9.801
10.0000	9.814
12.0000	9.883
14.0000	9.927
16.0000	9.965
18.0000	9.984

20.0000	10.009
22.0000	10.034
24.0000	10.047
26.0000	10.047
28.0000	10.072
30.0000	10.078
32.0000	10.078
34.0000	10.097
36.0000	10,122
38.0000	10.135
40.0000	10.147
42.0000	10.153
44.0000	10.166
46.0000	10.172
48.0000	10.179
50.0000	10.191
52.0000	10.191
54.0000	10.198
56.0000	10.191
58.0000	10.210
60.0000	10.216
62.0000	10.223
64.0000	10.223
66.0000	10.216
68.0000	10.229
70.0000	10.235
72.0000	10.223
74.0000	10.235
76.0000	10.229
78.0000	10.242
80.0000	10.242
82.0000	10.248
84.0000	10.248
86.0000	10.248
88.0000	10.248
90.0000	10.248
92.0000	10.242
94.0000	10.254
96.0000	10.254
98.0000	10.242
100.000	10.254

### Unit# 00033 Test 5

Setups:	INPUT 1
Type Mode I.D.	Level (F) TOC 00150
Reference Linearity Scale factor Offset Delay mSE	0.140

# Step 0 08/17 17:46:23

# Elapsed Time INPUT 1

0.0000	8.267
0.0033	8.260
0.0066	8.254
0.0100	8.260
0.0133	8.260
0.0166	8.254
0.0200	8.260
0.0233	8.267
0.0266	8.260
0.0300	8.260
0.0333	8.260
0.0500	8.229
0.0666	8.223
0.0833	8.260
0.1000	8.254
0.1166	8.254
0.1333	8.260
0.1500	8.260
0.1666	8.260
0.1833	8.260
0.2000	8.267
0.2166	8.267
0.2333	8.267

	0.045
0.2500	8.267
0.2666	8.273
0.2833	8.267
0.3000	8.273
0.3166	8.273
0.3333	8.273
0.4166	8.279
0.5000	8.286
0.5833	8.292
0.6666	8.292
0.7500	8.298
0.8333	8.305
0.9166	8.292
1.0000	8.305
1.0833	8.311
1.1666	8.311
1.2500	8.317
1.3333	
	8.317
1.4166	8.323
1.5000	8.317
1.5833	8.323
1.6666	8.330
1.7500	8.336
1.8333	8.336
1.9166	8.336
2.0000	8.342
2.5000	8.386
3.0000	8.380
3.5000	8.393
4.0000	8,405
4.5000	8.386
5.0000	8.405
5.5000	8.424
6.0000	8.443
6.5000	8.456
7.0000	8.468
7.5000	8.481
8.0000	8.493
8.5000	8.506
9.0000	8.518
9.5000	
	8.531
10.0000	8.537
12.0000	8.581
14.0000	8.619
16.0000	8.669
18.0000	8.701

20.0000	8.732
22,0000	8.751
24.0000	8.789
26.0000	8.820
28.0000	8.839
30.0000	8.871
32,0000	8.890
34.0000	8.909
36.0000	8.927
38.0000	8.946
40.0000	8.965
42.0000	8.984
44.0000	9.003
46.0000	9.015
48.0000	9.034
50.0000	9.047
52.0000	9.059
54.0000	9.078
56.0000	9.085
58.0000	9.104
60.0000	9.110
62.0000	9.129
64.0000	9.122
66.0000	9.148
68.0000	9.154
70.0000	9.166
72,0000	9.179
74.0000	9.185
76.0000	9.179
78.0000	9.204
80.0000	9.210
82,0000	9.217
84,0000	9.223
86.0000	9.229
88.0000	9.242
90.0000	9.248
92.0000	9.236
94.0000	9.254
96.0000	9.261
98.0000	9.267
100.000	9.261
110.000	9.292